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THE NEW YORK TRADE SCHOOLS—TEACHING YOUNG MEN BRICKLAYING PLASTERING PLUMBING, CARPENTERING ETC.—[See p. 196.]

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT.

No. 482,

For the Week Ending March 28, 1885.

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A NEW COMMISSIONER OF PATENTS.

The President has appointed as Commissioner of Patents Mr. Martin V. Montgomery, of Michigan, a well-known lawyer, a man of marked ability, vigor, and industry. He has always been noted for his thoroughness of research and for his success in accomplishing whatever he undertakes; but his undertakings of responsibilities have been rare; in fact, he is celebrated for his declinations of many proffered places of honor and profit, which ordinary people would have been only too glad to accept. Judging from his antecedents, the new Commissioner is not likely to allow the Patent Office to remain very long in its present unsatisfactory condition. All persons connected with the establishment will be expected to wake up to renewed exertions, and use every endeavor to put an end to the harassing delays of business which have for so long a time obstructed the usefulness of the bureau.

The new Commissioner has already entered upon his duties. We wish for him every possible success. The interests committed to his charge are of great magnitude, and we trust they may be wisely administered.

PATENT OFFICE EXAMINATIONS OF NOVELTY OF INVENTIONS.

The duties of the Commissioner of Patents are principally deducible from two sections of the Revised Statutes of the United States. In the interpretation of these enactments, the Commissioner, to a certain extent, is guided by the decisions of the courts. But notwithstanding all this, one great feature of the work of the Patent Office is that all of its staff are a law unto themselves. Each examiner acts for himself independently upon each application. His action may, and generally does, have reference to the law as laid down by the judges of the higher courts. That such reference may be omitted has very recently been proved in the practice followed in the registration of labels and trade marks. This special departure from the law, as laid down by the Supreme Court of the District of Columbia, has already been fully discussed in these columns.

Section 4,886 of the Revised Statutes states, as the necessary qualifications for a patentable device, that it shall be useful, new in this country, and shall not be described in any foreign printed publication, nor be patented abroad by another, nor be in public use for two years in this country. Furthermore, the patentee must be the first inventor. Such are the terms of patentability. In section 4,893 the Commissioner of Patents is directed to cause an examination of alleged new inventions to be made, to see if they are patentable under the law, and it is specially stated the patent shall be granted if such examination prove title to the privilege, and if it prove also "that the same" (invention) "is sufficiently useful and important." Thus it appears that the Commissioner of Patents has very arbitrary powers granted him. He is the judge of the utility of every device presented, and is at liberty to refuse a patent because the particular invention does not meet with his approval.

As it happens, a rigid application of this clause of usefulness is impracticable. The general utility of a device can seldom be correctly prophesied or foretold. There are so many patents, some of such restricted application, that only trade experts could form a judgment on many of them. Presumably for this reason, the question of utility is not very deeply gone into by the Office. It is sustained in this by the courts, it being usually held that the patented device is useful enough to come within the definition of the statute. But if the impracticability of this investigation of utility be urged, how much more impracticable does the search for novelty become. The invention must be new as far as all printed publications and patents are concerned. In patents alone this must give something like a million of references to be disposed of in one way or another. The American patents make up nearly one-third of the sum in question. To these must be added the Canadian, French, English, Belgian, and German patents as the most important. The field seems a vast one to cover, and is really such. No matter how accurately this great array of documents is arranged and indexed, a real search through it will always involve much labor and time. Then, the literature of the arts of all nations has to be studied. The search through the patents is comparatively insignificant compared to this examination. All the records of science in different languages, up to the latest dates, are the field to be gone over. Then, after literature and patent records have been exhausted, the novelty of the device is to be determined as affected by public use for over two years in this country. The other branches of the work are very much increased by this. The whole of the United States are to be traversed, and any anticipating device of two years' standing is to be found. Complaints of the delay of business of the Patent Office are frequent. Can such complaints be just, in view of the immense amount of work required before the granting of a patent?

Such complaints would be manifestly unjust, were the search above described really prosecuted to an end. But the truth is that it is not, and never will be. The Patent Office does not begin to exhaust the subject of novelty. This is proved every year in a multitude of court cases. Anticipations without number are annually shown in infringement suits. And these anticipations are not confined to unpatented structures that might well have escaped the Office's attention. Frequently they are found among United States and English patents, the simplest of all the grounds of the search.

In view of the fact that the courts so often nullify the work of the Patent Office, and that the search made by the Commissioner under the statute counts for nothing, it appears very questionable whether such system should be continued. When a patent is applied for under the existing *regime*, a very considerable delay in its granting is the regular thing. Such a delay is supposed to be necessary for the purposes of the search. But when the routine of the Office has exhausted itself, and the patent has been granted, the latter has no particular standing in court. It amounts to very little more than a registration. The novelty of the thing patented is inquired into just as if the Patent Office had made no investigation of it. If anticipating devices are found, the patent is declared invalid for the purposes of the suit at issue. No blame is attached to the Commissioner; the declaration of invalidity of a patent is too common a thing in the circuit courts to attract any attention, except from those interested.

The state of the case may be thus summed up: The Commissioner of Patents attempts to perform an impracticable task in ascertaining the novelty of an invention. To perform it, however imperfectly, he feels authorized to delay the granting of patents sometimes for several months in some of the rooms. He recognizes to its full extent this evil, and seeks for an abatement of it by asking for more examiners. In all this he overlooks the fact that the work would not be properly done, even if he had an army of officials to help him.

An impossible task is assigned him. No search can be conclusive. He can only strive to make it measurably good, if he will not dispense with it entirely. As we have before stated, we believe that the search, such as it now is, could be done in much less time than is devoted to it. Even with the present force and present system of searching, we do not believe in the necessity of the delay of business. But if the Commissioner will not abandon the search altogether, he should make it commensurate with his staff. He should settle on a maximum period of delay, and not let more time be devoted to any application. The imperfect examination now accorded is valueless in the courts, and from the force of circumstances the Patent Office certification of novelty always will be. The plain duty of the Commissioner would seem to be to shorten operations, and measure the extent of his examination by the number of his subordinates. We believe that as a rule the presumptive novelty afforded by a patent is well worth the government fees. But in the case of an important patent, it is rarely worth the long delay to which so many patents are now subjected.

It will, of course, be understood that when we speak of the plenary power of the Commissioner in granting or withholding patents we do it without losing sight of the right of appeal from his decisions. But inside of the Office his control is absolute, and is only subject to the higher court.

THE WORKING POWER OF MAN.

I have been puzzled by the very various figures given in engineers' and mechanical hand-books for the force or working power of man.

I think that, as compared with the standard English horse power, 33,000 foot pounds per minute, they vary from $\frac{1}{6}$ to $\frac{1}{17}$. The experiments quoted as those from which engineers and physicists have derived these various data disagree curiously in their products and in the deductions made from them by their authors.

It is difficult to estimate the work done with spade, shovel, axe, or wheelbarrow. But there is one application or use of human strength which gives absolute and correct minute results which, it seems to me, should be exploited and published.

When a man or any human being ascends a stair of regular grade, he lifts his own weight. If he carries in his hand a watch with seconds hand, he can note the time occupied in the work of ascending one, two, or three stories, and this height multiplied by his weight will give the absolute quantity of work done—foot pounds lifted—and this result divided by the time or parts of the minute will give the work per minute; dividing this again by 33,000 ft. pounds, the work of one horse power per minute, we will have a fraction of a horse power as the comparative measure of the man's work or force. If he ascends a tower stair until compelled to stop for breath, he will thus ascertain his extreme and ultimate force, power, strength. If he ascends rapidly till exhausted, he will accomplish in shorter time than when moving deliberately the work of which he is capable. Moving slowly, his effort will be longer continued, but he will in time reach a limit. By a series of experiments in this line by men of different forms, weights, ages, and condition of health and training, very interesting results can be obtained for the

physiological study of the human constitution. It would be interesting to determine the rate of increase and average of strength with advancing age; at what age a pound of flesh, blood, and bone in a normal human being is capable of exerting the greatest force. Lately the following experiments were made:

A man of nearly 69 years of age, weighing 214 lb., ascended a broad winding stair from first to second story of a house; height 14½ ft., weight raised 214 lb., time 16 seconds, rate of work per minute 11,665 ft. pounds; then the horse power during ¼ minute is at the rate of 0·353 H. P. Again, a man of the same age ascended two stories of the new Pension Building at Washington. This included 4 flights and the necessary landings; there are no winding stairs; weight 220 lb., height 42¾ ft., time 74 seconds, work done per minute 7,627 ft. pounds, horse power 0·231. Again, a man of about 69 years of age ascended to the third floor of the new Pension Building. First floor 20 feet, second 22·75 feet, time to 2d floor 29 seconds, to 3d floor 66 seconds; work done: 1st story, 4,400 ft. lb., rate per minute 9,109 lb., H. P. 0·276. 2d to 3d, work done 5,005 ft. lb., rate per minute 8,125 lb., H. P. 0·2462. Whole ascent 42¾ feet, work done 9,405 ft. lb., rate per minute 8,550 lb., H. P. 0·259. Another man, about 72 years of age, weighing 180 lb., ascended another similar stair 42¾ feet in 63 seconds; work done per minute, ft. pounds 7,328, H. P. 0·222.

For a short time the first experiment shows a man of nearly 69 years putting forth without suffering an effort greater than ⅓ of a horse power; but when the effort was continued for about 1¼ minutes, the average result was rather less than ¼ horse power. The other, older, man developed during 1 minute, or 63 seconds, a force of 0·222 H. P., or rather less than ¼ horse power. Looking into the details of these experiments, we find that the man of 69 lightly clad put forth for ¼ minute a force of 0·353 H. P., ascending a height of only 14½ feet. Rather more heavily clad, he put forth during ⅛ minute the force of 0·258 H. P., and during the following ¾ minute of 0·2118 H. P. the average during 74 seconds being 0·231 H. P. An older and lighter man exerted for 31 seconds, say ½ minute, the force of 0·2338 H. P., and for another half minute immediately following the first half, 0·2127 H. P.; average during 1 minute, or 63 seconds, the force of 0·222 H. P. Again, the man of 69 years, with a heavy overcoat, weighed 222¼ lb. He ascended 20 feet by stairs in 15 seconds, work done 4,450 ft. pounds, at the rate of 17,800 ft. pounds per minute, which is an exertion of 0·54 H. P.—over ½ horse power. A younger man, 151 lb. weight, ascended 61¾ ft. in 49 seconds; work done 9,324 ft. pounds, at the rate of 11,417 ft. pounds per minute, equal to 0·346 H. P.

M. C. MEIGS.

Washington, D. C., March 18, 1885.

ASPECTS OF THE PLANETS FOR APRIL.

MERCURY

is evening star until the 27th, when he changes his role to that of morning star. He holds the place of honor on the planetary records of the month, being the only member of the sun's family that contributes interesting incidents to the annals of April, for the month is specially uneventful and monotonous as regards the movements of our usually lively and active brother and sister planets. The most noteworthy incident in Mercury's course is his greatest eastern elongation. This event occurs on the 8th, at 2 o'clock in the morning, when Mercury is 19° 26' east of the sun. The present is the most favorable time of the year for a sight of Mercury as evening star with the naked eye. An intelligent observer cannot fail to find him if the weather conditions are favorable, and the directions given are faithfully carried out.

Three conditions are required for the most satisfactory view conceivable of Mercury at eastern elongation. The event must take place at the season of the year when the twilight is the shortest, in order to have a darker background of the sky for the exhibition. The planet must be in aphelion, or farthest from the sun, in order to have the elongation, or distance from the sun, the greatest possible. The planet must be at his greatest distance from the ecliptic, or sun's path in the heavens, on the north side, a necessary condition for the best observation of all the planets under all circumstances in the northern hemisphere.

These three conditions never occur together, for such is the position of Mercury's orbit that when the elongation is greatest possible, the planet is south of the sun, and not so well situated as when the elongation is less, and the position of the planet is north of the sun. We therefore never see Mercury under the most satisfactory combinations.

At the present elongation, the twilight is nearly the shortest, and the position of the planet is at his greatest distance north of the sun's center or north of the ecliptic. But the elongation is 19° 26' east of the sun instead of the maximum, 27° 47'. He is therefore far distant from aphelion, which, traveling with his amazing swiftness, he will not reach until the 11th of May.

In spite of these drawbacks, the smallest and swiftest of the planets will be a charming object in the early evening sky from the beginning to the middle of April. No other planet is like him. Not a fixed star can be compared with him in brilliancy when seen under the same light, unless it may be Sirius, which he somewhat resembles, shining with a white light, though we have seen him take on a golden aspect or a rosy hue. Easily as he may be seen in this latitude, it is almost impossible to detect his presence in the central and northern portions of Europe. It was a life-long sorrow to Copernicus that he never had a glimpse of the little planet that travels nearest to the sun.

We give Mercury's position at elongation, though he will be visible for eight or ten days before and after the event. On the 8th he sets about 8 o'clock, nearly an hour and three-quarters after the sun. The best time for observation is three-quarters of an hour after sunset, about 7 o'clock. The observer should command an unobstructed view of the northwest horizon, and note carefully the point where the sun sank below the horizon. Mercury will be found about 9° north of the sunset point. There are no large stars in his vicinity, but he is plainly visible to those who look in the right place. An opera glass is a valuable aid in picking him up. Before the 8th he will be farther south, and after the 8th, he will be farther north than at elongation.

Even when found he is easily lost, hiding himself in the twilight glow, and then suddenly reappearing, as if taking a conscious pleasure in baffling the curiosity of those who are earnestly seeking to behold his face. Audacity is the prominent characteristic of the smallest of the planetary brotherhood. The most painstaking observer has not succeeded in finding out the cause of the incomprehensible acceleration of his perihelion point. It is generally conceded that astronomical science has at present no means capable of solving the problem.

Mercury persistently hides from human view any small planet or planets that may make their swifter circuits within his own orbit, though practiced observers have traveled nearly round the globe, hoping to discover intra-Mercurial prizes during total eclipses. He manages as faithfully to keep the secrets of his physical organization concealed within his own domain, or in the dense atmosphere that possibly surrounds his solid crust.

We know little more about him than we did when the telescope was first invented. Amateur astronomers with ordinary telescopes have seen bright spots on his surface indicating a diurnal rotation of about twenty-four hours; blunted cusps and an irregular terminator, interpreted as the shadows of mountains, eleven miles high; a departure from a spheroidal form; and even a hole through the center. Practiced astronomers, with the largest telescopes in the world, fail to see these marvels on the disk of our swift-footed brother, and give little credence to them.

Nearly all that is known of Mercury may be comprised in a few lines. He has phases like the moon. At eastern elongation, he appears like a half moon; before that event he is gibbous, and after that event he takes on the form of a crescent. These are his aspects while evening star, which occur in reversed order while he is morning star. When beyond the sun, he is round and small, his diameter being 5". When nearly between the sun and the earth, he takes on the phase of a very slender crescent, his diameter being 10" or 12".

There is reason to hope that the astronomy of the future holds within its grasp the key to many scientific secrets, and that human ingenuity will succeed in finding out something more concerning the planet whose close proximity to the sun renders him an exceedingly difficult object for accurate observation.

On the 27th, at 10 o'clock in the afternoon, Mercury is in inferior conjunction with the sun, passing between the earth and sun, completing his course as evening star, and reappearing on the sun's western side to run his short course as morning star.

On the 28th, he encounters Venus, and the planets are in conjunction, Mercury being 1° 42' north. This event, occurring the day after Mercury's inferior conjunction, shows how near both planets are to the sun and how entirely they are hidden in his rays. It may seem strange that Mercury, having just passed between the earth and the sun, and Venus nearly ready to pass beyond the sun, should be side by side in the sky. But this is the way they would look to an observer on the earth if they were visible.

The right ascension of Mercury on the 1st is 1 h. 47 m.; his declination is 12° 57' north; his diameter is 6·4"; and he is in the constellation Aries.

Mercury sets on the 1st soon after half past 7 o'clock in the evening; on the 30th he rises at half past 4 o'clock in the morning.

JUPITER

is evening star. He is beautiful to behold as he makes his way over the celestial road, followed by his twinkling attendant Regulus. Planet and star keep about the same distance from each other during the month, for Jupiter is in stationary aspect, and varies little in his bearings. It is well to enjoy the present beaming aspect of the Prince of Planets, for his course lies southward, and he is approaching the aphelion of his orbit. More than six years must intervene before, in 1892, he comes round to perihelion and his greatest northern declination, when he will again take on his most superb aspect.

The right ascension of Jupiter on the 1st is 9 h. 56 m.; his declination is 13° 52' north; his diameter is 40·4"; and he is in the constellation Leo.

Jupiter sets on the 1st at a quarter before 4 o'clock in the morning; on the 30th he sets at 2 o'clock.

SATURN

is evening star, and he is a lovely object in the western sky, making his transit before it is dark enough for him to be visible, and sinking below the western horizon before midnight when the month commences. He, like Jupiter, is nearly stationary during the month.

The right ascension of Saturn on the 1st is 5 h. 12 m.; his declination is 21° 52' north; his diameter is 16·6"; and he is in the constellation Taurus.

Saturn sets on the 1st soon after half past 11 o'clock in the evening; on the 30th he sets about 10 o'clock.

NEPTUNE

is evening star, and fast approaching the sun. He is the first of the four great planets to disappear below the horizon.

The right ascension of Neptune on the 1st is 3 h. 18 m.; his declination is 16° 31' north; his diameter is 2·5"; and he is in the constellation Taurus.

Neptune sets on the 1st about half past 9 o'clock in the evening; on the 30th he sets at half past 7 o'clock.

URANUS

is evening star. He is, on the 1st, 12 m. east and 35' north of Eta Virginis, a third magnitude star in Virgo, having changed his position but little since his opposition. He may still be seen with the unaided eye, though the telescopic view is more satisfactory.

The right ascension of Uranus on the 1st is 12 h. 2 m.; his declination is 0° 33' north; his diameter is 3·8"; and he is in the constellation Virgo.

Uranus sets on the 1st shortly after 5 o'clock in the morning; on the 30th he sets soon after 3 o'clock.

VENUS

is morning star, is very near the sun, and will soon pass beyond the great orb.

The right ascension of Venus on the 1st is 0 h. 19 m.; her declination is 0° 34' north; her diameter is 10"; and she is in the constellation Pisces.

Venus rises on the 1st at a quarter after 5 o'clock in the morning; on the 30th she rises a quarter before 5 o'clock.

MARS

is morning star, creeping slowly on his course, receding from the sun and approaching the earth. April closes with Neptune, Saturn, Jupiter, and Uranus as evening stars, and Mercury, Venus, and Mars as morning stars.

The right ascension of Mars on the 1st is 0 h. 7 m.; his declination is 0° 12' south; his diameter is 4·2"; and he is in the constellation Pisces.

Mars rises on the 1st about ten minutes after 5 o'clock in the morning; on the 30th he rises soon after 4 o'clock.

THE MOON.

The April moon fulls on the 29th at 14 minutes after 1 o'clock in the morning. The waning moon is in close conjunction with Mars and Venus on the 14th, the day before her change. The new moon of the 15th is at her nearest point to Mercury and Neptune on the 16th, in conjunction with Saturn on the 18th, with Jupiter on the 23d, and with Uranus on the 26th. There is nothing of special interest in these conjunctions, for they are either invisible or moon and planet are far apart as they pass on the star-spangled road.

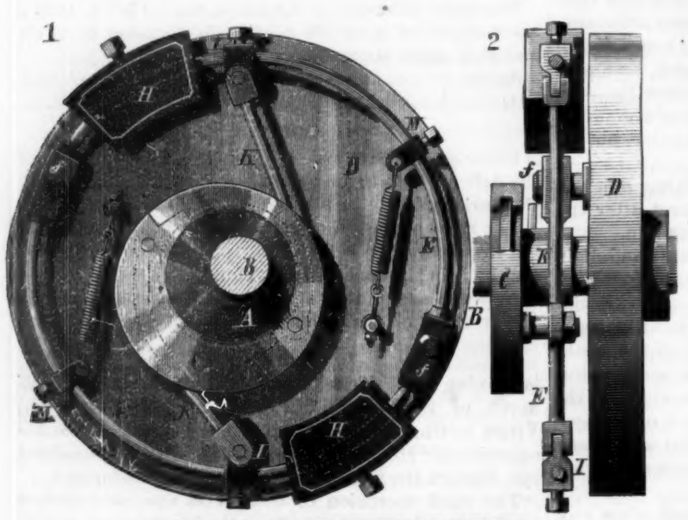
Our fair satellite, however, gets up a charming exhibition on a more southern belt of the earth's territory between the limiting parallels of 28° north and 38° south latitude. She occults the planet Venus on the 14th at 3 o'clock in the afternoon. The close conjunction occurring in this vicinity, for moon and planet are at that time only 6' apart, becomes, farther south, an occultation beautiful to behold. The slender crescent, only ten hours before new moon, occults the fairest of the stars, at that time nearly a full orb. But while the moon hides Venus, the sun's bright rays hide both moon and planet. Conjunction and occultation are, therefore, invisible to the naked eye, and, in this respect, we are as well off as our southern neighbors. The phenomenon may be observed with the aid of a powerful telescope, for through its light-gathering glass the brilliant planet may be followed in full daylight until she is nearly ready to pass beyond the great luminary. It is tantalizing that an occultation of Venus should occur under conditions so unfavorable for observation.

Furniture Polish.

The subjoined simple preparation is said to be desirable for cleaning and polishing old furniture. Over a moderate fire put a perfectly clean vessel. Into this drop two ounces of white or yellow wax. When melted, add four ounces of pure turpentine, then stir until cool, when it is ready for use. The mixture brings out the original color of the wood, adding a luster equal to that of varnish.

STEAM ENGINE GOVERNOR.

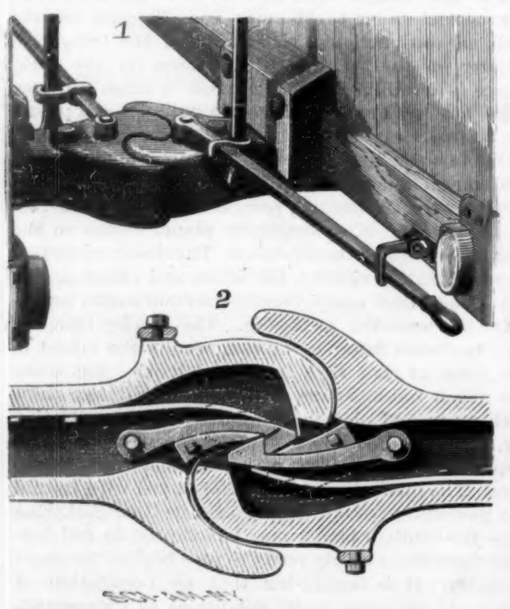
Fig. 1 is a side elevation, and Fig. 2 is an elevation at right angles to Fig. 1, of a governor of the centrifugal type recently patented by Mr. Thomas N. Perrine, of Anna, Ill. Fast to the engine shaft, B, is an eccentric, A, freely turning around which is a second eccentric, C. The usual strap is applied to the outer eccentric, and a rod passed to the valve. On the shaft contiguous to the eccentrics is a circular disk, D. Pivoted by studs, *f*, to one side of the disk are the curved arms, E, each of which is of half the length of the circle, so that when in the inward position the free end of one abuts against the pivoted end of the other. Rubber buffers fitted in the fulcrum ends prevent noise and concussion. Near the outer ends of the levers are adjustable weights, H, and to adjustable gibs, I, are pivoted links, K, connected to the eccentric, C. Springs are secured to studs on the disk and to adjustable gibs, M, on the levers, so that they tend to draw the levers inward. It will be seen that since all these parts are adjustable on the levers in relation to each other and the fulcrums, the movement of the levers by centrifugal force can be finely regulated. During the rotation of the disk the levers tend to move outward, causing the outer eccentric to turn more or less on the inner one. The effect is to shift the crowns of the eccentrics so that they approximate more nearly a concentric disk, thereby reducing the throw and lead of the valve. The parts can be set to insure this movement when the desired rate of speed is exceeded, so as to check the engine, and also a reverse movement by action of the springs when the speed is too low.



PERRINE'S STEAM ENGINE GOVERNOR.

IMPROVED CAR COUPLING.

The drawhead is cast in one piece formed with a longitudinal chamber to receive the coupling hook; through its rear portion passes the drawbar, which passes through plates sliding in the car frame and having interposed between them the buffer spring. The form of the cast metal coupling hook, which is pivoted within the chamber of the drawhead by a vertical pin, is shown clearly in the plan view, Fig. 2. A spring secured to one side of the chamber presses the head of the hook against the inner face of a cam plate, which is rigidly connected to a vertical pin projecting upward to receive the end of the uncoupling rod (Fig. 1), which extends to one side of the car and through a horizontal opening in a link block, through a vertical opening in which passes a lever pivoted to the side of the drawhead; the upper end of this lever is connected with the end of a second one fulcrumed to the end of the car and extending upward, so as to be operated from the roof. It will be seen that the cam plate may be turned against the coupling hook to force its head back by operating either of the levers. The front ends of the drawheads are recessed, as shown in both figures. The cam plates form stops to the opposing coupling hooks, so as to hold the heads normally beyond the inner face of the drawheads at the recess, so that as the cars come together for coupling the inclined faces of the hook heads will strike each other; when the shoulders pass each other, the springs cause the hooks to interlock automatically. The recessed form of the drawheads prevents lateral separation and relieves the hooks from all strains tending to unlock them. To uncouple the cars, either of the levers may be worked to turn the cam. The levers of opposing drawheads extend sidewise in opposite directions, so that uncoupling can be effected from either side of the train. By means of suitable hooks attached to the car, the coupling hook heads may be held either of the levers.



MULLER'S IMPROVED CAR COUPLING.

This invention has been patented by Mr. William Muller, and particulars can be obtained by addressing Mr. Philip Breitenbucher, of 32 Marietta St., Atlanta, Ga.

IMPROVED BARBED WIRE FENCE.

The barbs, A, B, C, are of sheet metal, and may be made of scrap tin or other waste pieces of metal, cut and bent so as to assume an open diamond form presenting sharp edges and angles, and having two holes midway of the length of the barb. The holes may be easily made by doubling the metal, and punching both at the same time. The bent form of the barb adds very materially to its strength, and it may, accordingly, be made of light metal. The barbs are strung on the wires by threading them through their holes, and after arranging them at suitable distances apart, twisting the wires to form a coarse strand. This throws the faces of the barbs on the sides of the wires, so that they can be seen plainly, and while perfectly secure they are free to turn slightly. The barbs will not penetrate like knife blades, which they would do if flat, and being widest in the middle stock cannot get fast on them. A barbed fence of this description may be cheaply made, and without the aid of expert labor.

This invention has been patented by Mr. George De Walt, of Kenton, Ohio.

Economy in Drop Forging.

Waste of scale in the oxidation of forge heated iron and steel makes a large proportion of the cost of the ordinary hand forging; but if, instead of repeated heatings with an indefinite number of blows of the hammer, there could be lesser number of heatings and only one or two blows to a heat, the cost by waste would be appreciably diminished.

Now look at a few facts: The waste of material in drop forging is the minimum waste. One heating, in many instances, is equal to ten—eleven—heatings for ordinary anvil practice. There are instances where the proportion in favor of the drop forging is much greater. The rapidity of the work by drop forging is greatly in its favor. The perfection of the resultant job is unquestionable.

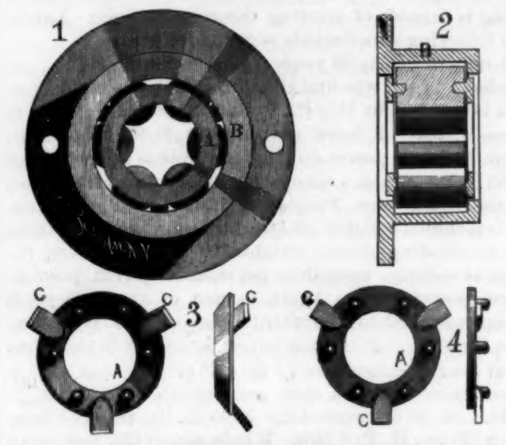
In a single instance a lump of round steel weighing $7\frac{1}{2}$ ounces passed through drop hammer workings six in number, and turned out its resultant product at a loss of only $\frac{1}{16}$ of an ounce.

IMPROVED TIRE TIGHTENER.

A tire tightener recently patented by Mr. Tyree Rodes, of Wales, Tenn., is shown in the annexed engraving. The ends of the tire are bent inward at right angles to fit against the ends of the fellies, and are formed with apertures for the passage of a screw bolt, which is formed with a flat head, E, held between one end of the tire and the corresponding end of the felly. The washer, F, is between the other end of the tire and the nut, G. The free end of the bolt is screwed into a long nut, J, which rests against a plate, K, formed with a stud that enters a notch in the end of the felly. A series of U-shaped washers is mounted on the bolt between the ends of the tire, their outer edges being straight and flush with the outer surface of the tire. A wedge-shaped piece of leather is placed between the tire and the nuts, G J, to lock them in place. When the tire is to be tightened, one or more of the washers are removed, and the nut, G, drawn up tight to bring the ends of the tire together. Then the nut, J, is turned to force the ends of the fellies from each other, thereby pressing them firmly against the tire; at the same time the dish of the wheel can be adjusted.

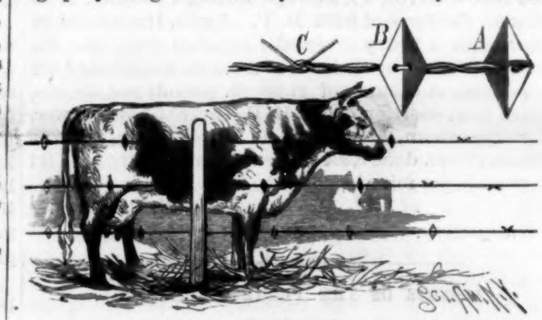
FRICTION ROLLER BEARING.

As generally constructed, friction roller bearings involve more or less machine work in connection with



DABOLL'S FRICTION ROLLER BEARING.

screws, tapped holes, riveting, etc., which so adds to the cost as to practically exclude them from certain cheap grades of blocks; the object of the improvements herewith illustrated is to so simplify their construction as to materially reduce their cost without impairing their efficiency. These bearings are for use in blocks, sheaves, etc. Figs. 1 and 2 are end and side views, respectively, of the bearing; Fig. 3 shows two views of a pivot ring before being applied to the bearing, and Fig. 4 shows its form in the bearing. The solid shell is provided with the usual flange and internal annular recess for the reception of the rollers, each of which is axially bored at each end to receive the pivots it revolves upon. The pivot rings are located at each end of the recess, and pivots are formed on the inner face of each. The rings are also formed with three or more lugs, *c*, projecting radially from the periphery. When in their normal condition, the rings are frustums of hollow cones with lugs projecting downwardly and outwardly from the

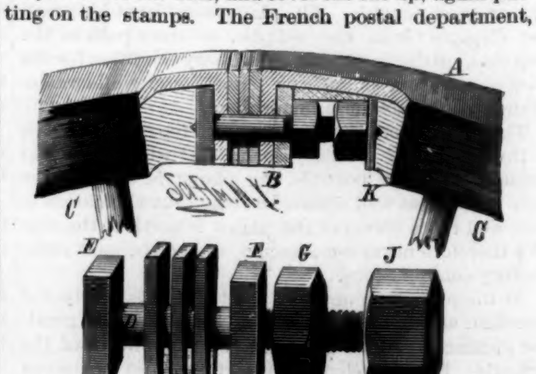


DE WALT'S IMPROVED BARBED WIRE FENCE.

lower edges. A ring is placed in the recess and then flattened out, thereby increasing its diameter and causing its lugs to properly occupy the recess. The rollers are then introduced, when the second ring is placed at the other end of the recess and forced inwardly into a flattened condition, causing its lugs to enter the recess. The rollers are thus confined in their proper working position. New rollers and rings may be substituted when the old ones become worn. This method of construction produces at low cost a durable and effective friction roller bearing. At the end of a very severe test of a sheave made in this manner, the rollers and pin were found very perceptibly worn, but the rings were uninjured.

Additional information regarding this invention may be hed by addressing the patentee, Mr. Austin P. Daboll, P. O. Box 1037, New London, Conn.

LETTER-RATS, when several stamps are placed closely together upon letters containing money, after taking off the stamps, cut a slit into the envelope, through which they abstract the bills, and cover the cut up, again putting on the stamps. The French postal department,



RODES' IMPROVED TIRE TIGHTENER.

bringing this practice to the notice of the public, recommends, therefore, that when more stamps than one are used, they be placed about one-eighth inch apart.

Bleaching Ostrich Feathers.

1. Wash the feathers with Castile soap and rinse *them thoroughly with lukewarm water* in order to remove all the grease and soap which may stick to the flue.

2. Soak feathers in a bath composed of one gallon of ammonia, 20° Be., to every eight gallons of plain water, for about 8 to 10 hours.

3. Take feathers out of this bath, and squeeze out the excess of ammonia which is in the flue by passing feathers through a wringer.

4. Put feathers in a bath composed of 5 gallons peroxide of hydrogen, with addition of 12 to 16 ounces of ammonia, let it work slowly, stirring feathers from time to time for about 6 hours; after 6 hours' working, put feathers in one side of the bath and add 5 gallons peroxide of hydrogen and 3 to 4 ounces of ammonia. Stir the bath well so as to insure the mixture of the peroxide with the ammonia. Then let the bath work for 9 to 12 hours more, after that time add again 2 or 3 ounces of ammonia. The peroxide will work yet for 12 hours more until it gets exhausted, and you may ascertain the fact by the following process:

Take a small quantity of the bath in a tumbler and throw in a few crystals of permanganate of potash; should bubbles of gas appear, it is proof that the peroxide is working; yet if none appear, the peroxide is exhausted.

Then the feathers have to be rinsed 3 or 4 times in lukewarm water, and then to be put in a second bath of peroxide of hydrogen, which has to be prepared as follows:

To 2½ gallons peroxide of hydrogen add 2½ or 3 gallons plain water and 8 ounces of ammonia, and put in the feathers. Let the bath work so for 10 hours, and after add again 2 ounces of ammonia as before, and it will then work 12 hours more until it is exhausted.

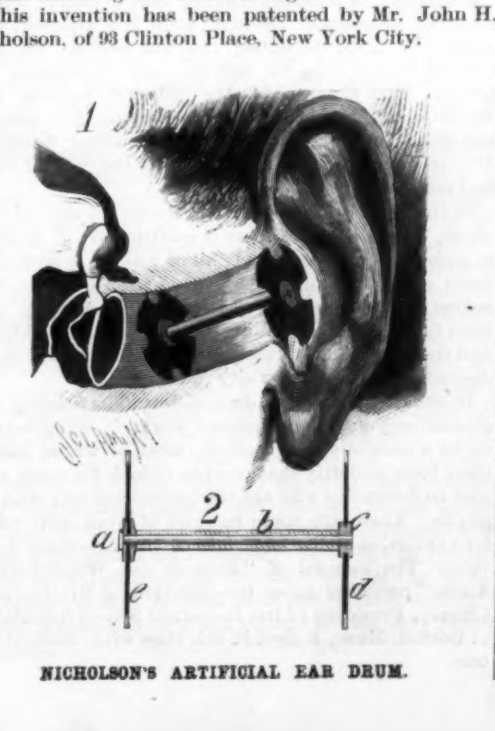
It is claimed that every one who will follow carefully the above directions will succeed to make white the darkest gray feathers, say 10 pounds of feathers by using about 7 to 7½ gallons of peroxide.

After the feathers have been taken out of the peroxide bath they must be rinsed thoroughly with lukewarm water 2 or 3 times, and after soaking them again in a soap solution for 6 to 8 hours, rinse them in lukewarm water, in order to remove all soap and dirt remaining in the flue.

ARTIFICIAL EAR DRUM.

The object of the invention herewith illustrated is to provide an artificial ear drum to be used by deaf persons. It is constructed of a magnetized steel rod, provided with a gold or silver covering, carrying a soft rubber disk on each end; the disks are held in place by gold washers, and are formed with ventilating apertures and notches. The magnetized steel rod, *b*, is surrounded by a closely fitting gold or silver tube, and at one end is the head or button, *a*, against which rests a rubber washer. Between this washer and a gold one the disk, *e*, is held. On the opposite end of the rod a thin soft rubber disk, *d*, is held by two gold washers, *c*. That end of the device carrying the soft rubber disk, *e*, is inserted in the auditory channel (Fig. 1) of the ear until the head, *a*, adjoins the delicate organs of the ear. The magnetized rod receives the impulses of the air wave, and carries them along and discharges them to the nerve of the ear with slight magnetic force, causing the organs to assume increased action. The disks hold the device in position, and protect the organs from coming in contact with the gold parts. The front washers, *c*, or disk receive the sound waves, and convey them to the rod. The outer disk is held on the outside part of the ear, just out of sight but within reach of the fingers, to permit inserting and withdrawing the instrument.

This invention has been patented by Mr. John H. Nicholson, of 93 Clinton Place, New York City.



NICHOLSON'S ARTIFICIAL EAR DRUM.

TCHEBICHEF'S WALKING MACHINE.

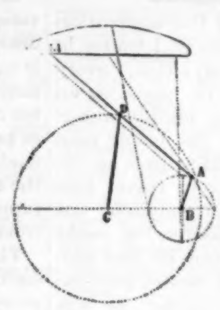


FIG. 1.

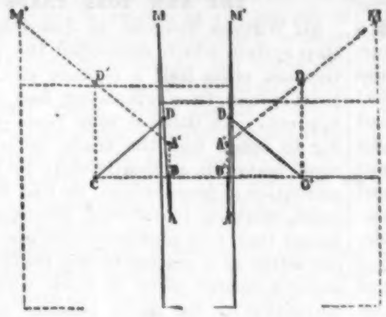


FIG. 2.

The idea of a walking machine is not entirely new, since as many as forty patents have been taken out in France for such a device, which is one that may be put to profitable use. In the season of snow and hoar frost, locomotives run with difficulty on the rails, and the idea has occurred that it would be well to add to them a temporary mechanism after the manner of feet as a substitute for wheels. Thus, we find in the galleries of the Conservatoire des Arts et Metiers three samples of locomotives with feet, devised by Mr. F. Hermann. One of these, with a single motive cylinder, is a small model that may be made to move forward by pressing a rubber bulb; another is provided with four cylinders, and the third is arranged for curves of short radius. It will be understood that this kind of a locomotive may be very usefully employed under other circumstances.

The principal mechanism of Hermann's walking machines consists either of eccentrics or of jointed parallelograms. The object of this article, however, is to make known a mechanism that has just been devised by Mr. Tchebichef. We ought to say that it is a question here principally of a theoretical solution. It is for professionals to study the results of the experiments from the data given by the illustrious professor of the University of St. Petersburg. What we usually call a jointed parallelogram in mechanics is a quadrilateral, or figure formed of four sides of invariable length, one of which remains fixed. The extremities of this latter (which is the base) are the centers of revolution of the two adjacent sides, and the side opposite the base is balanced in a more or less complicated manner, according to the respective sizes of the quadrilateral's sides. Watt's parallelogram is a well known example of such a mechanism. It is often applied in steam engines for directing the rod of a piston which must effect as rectilinear a motion as possible. Mr. Tchebichef long ago demonstrated that with the jointed parallelogram it was impossible to obtain a motion that was absolutely mathematically rectilinear. It is to Mr. Peaucellier that we owe the first accurate solution of the problem of constructing a straight line; but this, although published in 1864, has remained unnoticed.

In 1870, a student in the University of St. Petersburg, a Mr. Lipkine, presented to Mr. Tchebichef a jointed apparatus that permitted of tracing a straight line mathematically. But this in nowise affected the conclusions of Tchebichef, since the jointed apparatus was not a parallelogram, but contained seven rods or sides instead of three. The student received the encouragement of his professor, his university, and his government for this admirable discovery, which was but the Peaucellier apparatus revived. As for General Peaucellier, he was rewarded later on, the French Academy having given him a fine prize.

In order to draw a straight line, a ruler is made use of; but this in the first place must be verified. While we are purchasing it of the dealer, we place our eye at

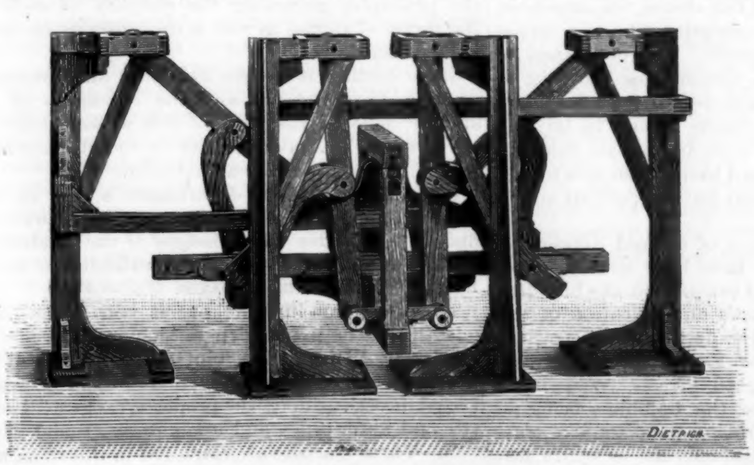


Fig. 3.—POSITION OF REST.

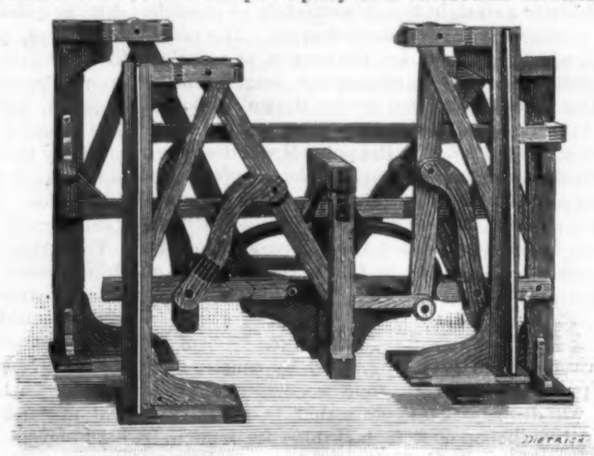


Fig. 4.—THE RIGHT FORE FOOT AND THE LEFT HIND FOOT RISING IN ORDER TO ADVANCE TO THE RIGHT.

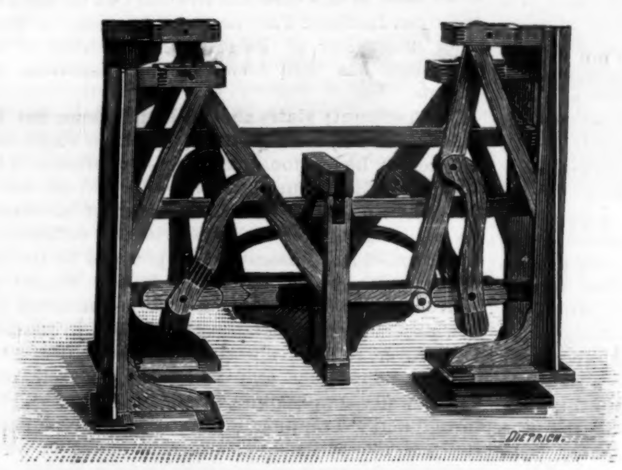


Fig. 5.—A FURTHER ADVANCE.

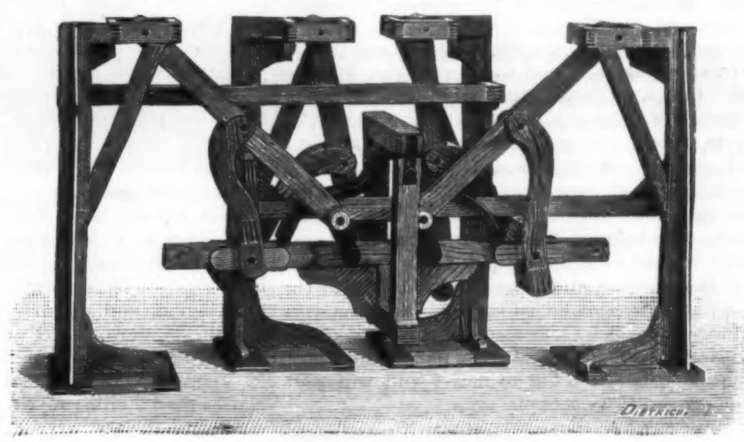


Fig. 6.—SECOND POSITION OF REST.

one extremity of it, in order to see whether it is true. We further verify it in a surer manner by drawing a line at one side, and turning it over upon the other surface in order to see whether the second line coincides with the first. For the more than forty centuries that geometry has been studied, no one has perceived that we are ignorant of the method of drawing a straight line. Meanwhile the professor of geometry has been teaching only exact constructions! Even at the present day, although the Peaucellier apparatus and its congeners have replaced the Watt parallelogram, our elementary works are silent in regard to this discovery—this mechanism—which is explained with the square of the hypothenuse by a clear demonstration given by Colonel Mannheim, professor at the Polytechnic School.

But to return to our subject. We must not abuse theoretical solutions beyond measure, since they are data and guides for the professional man; but it is necessary to take account of the operation of the machine, of the friction, and of the performance. By means of a new kind of calculation, due to Mr. Tchebichef and founded upon arithmetical methods whose germ is found in the work of Euler, the learned professor set out to find dimensions such that one of the points of the movable side (opposite the fixed side) should describe a straight line as accurately as possible.

Fig. 1 represents the new parallelogram. The points B and C, which are fixed, are the centers of rotation. The opposite side A D is of constant length, and its extremities describe the two circles shown by dotted lines. If the line A D be prolonged an equal length, that is to say, if D M = A M, the point M will describe a curve, which is here not the *curve of long inflexion* of Watt, but one of which a certain part very nearly approaches a straight line—as nearly as possible with the conditions imposed—provided the dimensions of the parallelogram be as follows, in taking the side A B as a unit of length:

$$C D = A D = A M = \frac{3+\sqrt{7}}{2}, \text{ and } B C = \frac{4+\sqrt{7}}{3}$$

In this case, as may be easily proved by constructing such a parallelogram with four wooden rulers, the point M will describe a trajectory that is sensibly rectilinear, when the apex A is describing its semicircle to the right. After passing over this part of the trajectory, the point M will rise, and effect its return in gradually mounting as far as to the center of its travel, and in descending according to the same law after getting beyond the said center.

Let us now suppose (Fig. 2) that such systems are applied to two cranks soldered to an axle, and directly opposite. In this case we obtain a mechanism in which the revolution of the axle is converted into a motion of two points, which, in turn, run over the same straight line, and one of which rises successively above such line after having passed over it when the other was descending upon it in order to do the same. Let us place at the side, as a balance, an apparatus that is symmetrical with respect to a central point (the navel, so to speak) of the machine, and let us connect it with the first by a fixed bar; and let us support the extremities of the four levers M by four feet, like those of an elephant. Now, if we pull towards the right with a cord, all this apparatus will begin to move, and will walk like a quadruped (Figs. 3 to 6).

If we cover this wooden apparatus with cardboard to imitate skin, and give it the form of an elephant, with tusks of ivory, we shall have, according to the dimensions, a plaything for the child or an object for use in spectacular dramas in theaters. If a clock or spring be placed inside of it, the apparatus may be made to walk automatically. With the leg of a giraffe, it might be utilized as a velocipede in the department of Landes; but the addition of so long legs would very naturally increase the cost. It would be more interesting to experiment with the apparatus on locomotives.

In conclusion, we may say that Mr. Tchebichef's apparatus gives the solution of a very important problem in mechanics. In considering only the rectilinear parts of the trajectory of the points M, we find that they produce with sufficient approximation the same effect as the equal arcs of the circumference of a revolving wheel, when the radius of the latter is very great. In other words, this mechanism performs the role of an infinitely large wheel.—*Science et Nature.*

The Gas Engine.

A gas engine, rated at 2 horse power, developing about 1·5 horse power, and running ten hours per day, will cost 10 cents per hour, including all items of expense of operation. These are: For interest, 5 per cent on first cost, credited to ten hours of actual running per day, 0·80 cent per hour; for repairs and depreciation, 5 per cent on first cost, similarly credited, 0·80 cent per hour; for oil, 0·40 cent per hour, and for gas 8 cents per hour. The current expense of operating such a gas engine will be about 6·7 cents per horse power per hour. Its first cost approximates $475. No charge for attendance need be allowed. Additional advantages are the cleanliness of the machines, the ease with which they are started, and the absence of risk from fire.

THE NEW YORK TRADE SCHOOLS.

Sir William Siemens, in describing the apprenticeship system which controlled the principal trades in German cities half a century ago, says that "every journeyman, in commencing, had to be bound as an apprentice for three or four years—the master engaging to teach him the trade; before the young man could leave his apprenticeship, he had to pass an examination as journeyman; he had then to travel four years, working in different places, and remaining not longer than four months under one master, but could not settle as a master in his trade until he had produced a master piece of work which would pass examination by the guild masters' committee; he was then pronounced a master, and allowed to marry."

The guild system in Germany was abolished in 1869, but the apprenticeship system, under which boys are regularly indentured to trades, still furnishes most of the skilled artisans yearly added to the ranks of industrial workers throughout the Continent of Europe and in the British Isles. This European apprenticeship system is also largely supplying the demand for skilled labor in our own workshops, for our trades unions do not encourage the employment of apprentices, although they are ever ready to admit to membership, as quick as he reaches our shores, the carpenter, bricklayer, plasterer, or stonecutter who has served his time under a foreign master. The old system of apprenticeship has, in fact, almost ceased to exist in America, and there is nothing yet to take its place. The demand for skilled workmen is only to be supplied by these foreign accessions, by the fast thinning out ranks of those who learned their trades in a former generation, and by those who have picked up only a "smattering" of a trade.

To partially take the place of the old apprenticeship system, trade schools have been recommended, where instruction and actual practice in the handling of tools could be obtained, and an institution of this kind forms the subject of our first page illustrations this week. It is situated on First Avenue, between Sixty-seventh and Sixty-eighth Streets, occupying a plat of land 200 by 114 feet, the buildings being of brick, one story high, with a large percentage of glass surface. Three of the workshops are 30 by 72 feet each, and 18 feet high, one being used for a plumbing shop, one for the plasterers, and another divided into three parts for the fresco painters, pattern makers, and wood carvers. In the rear is a building 40 by 120 feet used for the bricklayers and stonecutters, and adjoining this is a structure 30 by 50 feet used as a carpenters' shop. The bricklaying room has an earthen floor, the plastering room floor is concreted, with a Portland cement top, and the other shops have wooden floors, every part being thoroughly lighted at night with gas.

These schools were first opened in November, 1881, by Colonel R. T. Auchmuty, an architect, only plumbing and fresco painting being taught the first season, to a total of 33 students. In the season of 1882-83, bricklaying, and pattern making for moulders and machinists, were added, and the pupils numbered 88. In the season of 1883-84, instruction was also given in wood carving, stone cutting, and plastering, the classes then numbering over 200, and during the present season (1884-85) carpentering has been added.

Although it is a part of the scheme on which these schools are organized to give day instruction in the several trades, there has not yet been sufficient demand for such lessons to justify the organization of day classes, and the instruction now given is confined to a course of three evenings a week—Monday, Wednesday, and Friday—for the five months from October to April. The institution is not intended to be either a charitable or a money-making one, a charge being made for instruction based on what it is expected will ultimately cover the outlay, but the receipts for tuition have not thus far met the cost of running expenses. The charges for the different courses, five months each, are as follows: Bricklaying, $17; plastering, $15; plumbing, $12; and all the other branches $10 each, these figures covering also the use of tools and materials.

In the school for plastering, shown in one of our views, one side of the room is partitioned off to form a number of alcoves, nearly all of which are now plastered and hard finished by this season's class. The course includes scratch coating, brown coating, and hard finishing, and running cornices and mouldings, and the work now on the walls is such as would do no discredit to many of our city journeymen.

In the carpenter shop, door and window framing, and general carpenters' and joiners' work, is being carried on by a class of young men, the most of whom handle their tools so deftly that one has to look for some minutes to determine who are the instructors and who the pupils. There are some samples of work here ready for exhibition at the next fair of the American Institute. The manual of "How to use Wood-working Tools," prepared under the direction of Mr. George L. Cheney, President of the Industrial School Association of Boston, Mass., is used in this class with marked success.

In the department of wood carving, and in that devoted to pattern making, the work is all done from drawings. Some very elaborate work in wood carving is now to be seen well advanced on the young workmen's benches, and patterns which present considerable difficulty to experienced pattern makers are shown as part of the work of this season's class. The patterns made are always tested in actual practice, to explain the management and setting of the cores, a four-blade propeller, two feet in diameter, being cast last week from a pattern made in this shop.

The instruction in bricklaying covers the laying of eight, twelve, and sixteen inch walls, the building of piers, arches, flues, fire-places, setting sills and lintels, etc. In this, as in all the other departments, the instructors are practical workmen of exceptional skill, who go around among the young beginners, correcting faults and explaining how the work should be done, occasionally taking the trowel themselves to illustrate their comments. The work done evenings is torn down by laborers in the day time, the mortar made and the brick cleaned for relaying, so that there will be no unnecessary waste of material and no frittering away of time by the evening classes. Besides this manual instruction, the properties of mortar and cement, the principles governing the stability of walls and the thrust of arches, as well as the construction of flues, are explained.

Stone cutting is taught on plain and ornamental work in brown stone, and the specimens of work already done by members of this season's class, who never before had a stone cutter's tool in their hands, would do credit to many an old hand.

In the fresco painting department, a view of which takes up the center of our first page, are shown some fine oil and water color designs of the students, for ceilings of rooms, which are to be exhibited at the next Fair of the American Institute.

The instruction in plumbing is both practical and scientific. The practical part includes dressing pipe, making lead joints, wipe joints, sand bends, lead safes, etc.; and the scientific instruction covers lectures and verbal directions upon the proper arrangement of service and water pipes, and upon drainage and ventilation. Three teachers are employed in this room, which is fitted up with all the appliances of a first-class shop. Work done in this class has received two medals at the American Institute Fair, and at the request of the U. S. Commissioner of Education, an exhibit of work done here has been forwarded for display at New Orleans.

Col. Auchmuty states that although none but first-class mechanics have, from the first, been employed as instructors, he has found it of great importance to have a clearly defined course of instruction laid out for each class, showing the ground that it is most necessary to cover during each season, otherwise the sufficient consideration of many essential points would be too much a matter of accident. His ideas in this respect have been admirably worked out in a series of seven question papers for the guidance of the class in plumbing. They cover, respectively, the following subjects: "Soil pipes," "Trapping and ventilation of soil pipes," "Cold water supply pipes," "Boilers," "Tanks," "Fixtures," and "Trapping or Fixtures." Accompanying the first one of these papers is a direction which it would be better for society if every plumber would scrupulously heed, viz.: "Do not use inferior material to secure a job, or even to oblige the owner; a leak in a soil pipe may cause death, or the ruin of a life through sickness."

At the lectures the students are given the printed questions on the subject to be discussed, and under each question is a blank space in which the student is expected to write his answer, as the matter is being explained by the lecturer. The following are among the questions on soil pipes, which is the subject of the first lecture in the plumbing course:

Of what materials are the different kinds of soil pipe made?

Why is cast iron used exclusively in New York city?

Why is cast iron considered the best?

What material is used for soil pipes in England?

Why is lead objected to in this country?

What should be the thickness of 2, 3, and 4 inch cast iron pipe?

Give the weight per foot of 2, 3, 4, 5, and 6 inch cast iron pipe, in 5 foot lengths, with hub and spigot?

Is there any way of testing the uniform thickness of soil pipe?

What is meant by sand holes and flaws?

Describe how cast iron pipes should be calked at the joints.

What is the least depth the ring of lead formed by calking should have?

What is a rust joint?

Is there any objection to its use?

Why are putty, mortar, and cement joints objectionable?

What is the usual size of a soil pipe in New York?

Is it usual to make the horizontal soil pipe in the cellar larger than the vertical soil pipes?

How large should the soil pipe be from the highest fixture to the roof?

Should any allowance be made for the expansion and contraction of soil pipes?

What is the regulation of the Board of Health in regard to soil pipes in cellars?

What fall per foot should a horizontal soil pipe have?

How can a soil pipe be cut after it is put into a building, to allow the insertion of a branch pipe?

What is meant by the peppermint test, and how is it applied?

In a building over seventy feet high, how is the water test applied?

It is not expected that the course of lessons given at these schools will make the recipients complete masters of their trades, and able at once to cope with regular journeymen therein; but, from the experience thus far gained, it is proved that the knowledge here imparted forms the very best groundwork for the quick making of a first-class workman. There have been several instances where workmen have gone from these schools and at once earned journeymen's wages as plasterers and bricklayers, but these cases have been considered exceptional, as, although the student may have gained a better theoretical knowledge of the business in one term than is possessed by ordinary journeymen, it generally requires a longer time and more practice to gain the manual dexterity; that is, the skillful journeyman will lay about 1,500 bricks in the time it will take the average student from these schools to lay 500 or 600, the increased speed being acquired by practice, and so it is comparatively in other trades. The walls of the building in which bricklaying is taught, and also those of the plasterers' room, were built by the students, who were paid for their work in proportion to the number of brick laid. The founder of these schools, also, last year, in order mainly to give employment to a number of the young bricklayers, built the foundations and heavy lower story walls of what will eventually be some tall buildings, and says the work of his graduates on this job will compare well with any other bricklaying in the city; it is, in fact, so satisfactory that he will employ some of the members of this year's class in putting up the walls of some five-story buildings to be erected during the coming summer.

Although, by the terms of admission to the various classes, instruction at these schools is intended to be limited to those between 16 and 25 years of age, there has been no earnest effort, until the past season, to enforce this regulation. Experience has proved, so far as the history of these schools goes, that men who have failed at various occupations, and who have not settled down to the learning of a trade until they are over 25 years old, do not take hold and stick to their work with that spirit and resolution necessary to become a skillful workman, and so it is the intention hereafter to confine the membership to those within the specified ages. Other men who desired admittance, although most of them would come under the preceding provision, were the janitors of various flats and office buildings, who simply wished to learn enough to enable them to do their own jobs; as such students did not intend to completely learn the trade, and their work was not likely to be particularly creditable, it was decided not to admit them to the privileges of the trade schools.

When these schools were first started, some difficulty was experienced in engaging competent teachers, the best mechanics being afraid that they might be expelled from their trade-unions if engaging in such work, but this trouble is now over, and many union men bring their sons to the school, and come in the evening to help the instructors teach them. The Master Freestone Cutters' Association and the Journeymen Stonecutters' Association have both passed resolutions indorsing the trade schools.

The question as to how the call for skilled labor in the United States is to be met, in the future, may possibly find its solution in the experiment now being worked out in the New York trade schools, or some plan on the same principle. In many of the old trades it would be difficult for an apprentice now to thoroughly learn a business, as it was learned a generation ago, even were it not for the opposition of trade societies. The introduction of machinery and the division of labor have greatly changed the conditions of industry. The carpenter finds that door and window frames, all kinds of mouldings, and in fact all the interior work of modern buildings, come ready-made from the factory; the blacksmith or machinist sees that the most difficult pieces of work in his line are now generally the product of the stamping or draw press, or that some other labor saving device shortens the old process; and so it is, in a greater or less degree, through all our modern industries. But notwithstanding all these changes, that facility in the use of tools, that knowledge of the working of materials, that judgment of design and fitness in an article, which come only as the result of practice and study together, are still most important requisites for the workman in any branch of industry. And yet the American employer now troubles himself but little on these points; the whole tendency is to engage boys in the same way as men, simply for what they are worth, which causes so many, taking only casual employment, or following unskilled pursuits for temporary gain, to grow up without any higher ability than that of laborers. It is easier for a young man to get an opportunity to learn a trade in the country than in the city, as there are not such rigid trade-union restrictions in the country, but the standard of workmanship is not as high as it is in the cities. In the city there are thousands of young men whose education and bringing up admirably adapt them for the mechanic arts, but their places are now largely filled by foreigners and mechanics from the country. For such young men, whose lives have in many cases been marred by the efforts of trade unions to limit the number of employes, these trade schools offer an opportunity hitherto unattainable to learn a trade, or to improve themselves therein should they be already so engaged; and to such extent as they are sustained, they promise to prove a not inefficient substitute for an apprentice system.

Pneumonia.

This disease has been very prevalent in this city, and in other northern places, the past winter.

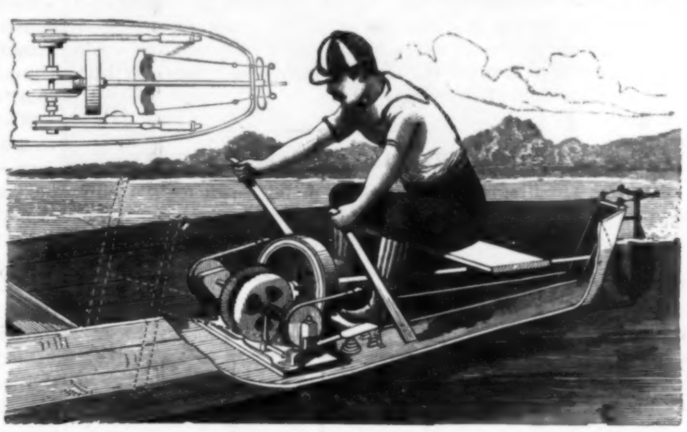
The chilly winds of March have not been the means of lessening the fatality of the disease, and persons in middle life, as well as old people, are stricken down, and die within a few days after their attack. B. V. French tells in the *Boston Journal* what pneumonia is, and what to do in the first stages of the disease.

His mode of treatment seems rational; certainly, it is simple enough, and most of the remedies can be found in out-of-the-way places, away from physicians. Pneumonia, says the writer, is inflammation of the lungs. When the inflammation is on the lining of the chest, it is pleurisy. The two may be combined. Pneumonia is a dangerous disease, and requires prompt action. It is preceded by a chill, from which it sometimes is difficult to restore the natural heat. This chill is followed by a high fever, in which the heart beats rapidly.

Chills may come from other causes than pneumonia, but unless sure of the cause and sure that it is not dangerous, it is safe to suspect a coming pneumonia, and to send at once for a physician. On no account attempt to manage the case without one. The disease is too serious to warrant such an attempt. Until he arrives, do what you can to equalize the circulation and temperature. Keep in bed between woolen blankets or sheets, increase the temperature of the room, apply to the affected parts old soft cotton (not linen) cloths wet in hot water, in which has been mixed one-half of a teaspoonful of mustard to a quart of water, and to this apply heat from tins or bottles of hot water or hot bricks. Rubber water bags are best; apply heat in the same way to the feet. Do not increase the quantity of mustard. The object is to excite action in the skin, but to avoid an irritation that would hinder or destroy action. As these cool, replace them at once with others, not allowing the temperature to reduce at all. On no account must the patient get out of bed.

For medicine give aconite, four globules, every half hour; this is homœopathic. When the perspiration returns and the patient can sleep, let him sleep; continue the heat for a time, and when it is reduced let it be done with great care. If the patient needs food, let it be of a plain, simple kind. Avoid cold drinks until the natural condition of the skin is restored.

MR. IVAN LEVINSTEIN, in conclusion of his defense of aniline dyes against the charges, in the London *Times*, of their poisonous effects upon human health, cautions against the use of chrome yellow and chrome orange in dyeing cotton articles which are to be worn next to the skin, because these dyes consist in a salt of lead, which may be absorbed by the skin and produce disease.



BATZ'S HAND PROPELLER FOR BOATS.

How to Make a Paper Pan.

I recently required a dish to silver some paper on, and none could be obtained near where I live. I made a dish in the following manner: First cut out a block of wood the exact size and thickness of dish required. Then take a sheet of cartridge paper, paste it with flour paste and rub in the paste well, letting the paper be thoroughly soaked with it. Then place the paper evenly on the wooden block, turn down the edges smoothly and double the corners back, rubbing them down well. Be very particular with the first sheet, because if you get that smooth, the rest is easy. Follow with another sheet of cartridge paper, turning the surplus or slack paper at the corners, the opposite direction to the last. Follow with five or six sheets of old newspaper in the same way, and cap with another sheet of cartridge. Put the block with the paper on it into an oven, and bake till dry. Then take out the block and trim the edges. Paint the outside of the paper dish with varnish. Pour some varnish inside the dish and let it soak in, and then pour off the surplus. Bake in the oven again. After the varnish is hard and dry, warm the dish until it is hot enough to melt paraffine wax. Pour some melted paraffine into it, and tilt it about till the bottom and sides are evenly covered; pour off the surplus, and when dry you can use for toning, developing, or even silvering paper. Of course the above is only recommended as a substitute for glass or porcelain when the latter cannot be readily obtained. Paraffine alone may be used if you like.—*F. Whitehead, Photo. Times.*

HAND PROPELLER FOR BOATS.

The engraving herewith shows a device for propelling and steering a boat which is very simple in construction, easy to manage, and which will drive the boat at good speed with the expenditure of but little muscular power. Journaled transversely is a shaft carrying two beveled wheels, between which is a third beveled wheel mounted on the forward end of the propeller shaft. By means of a lever placed within easy reach of the foot of the operator, the transverse shaft may be shifted so as to make the third beveled wheel engage with either the right or left hand wheel on the transverse shaft, thereby turning the propeller shaft forward or backward. To hand levers pivoted to the bottom of the boat are secured the ends of straps, the opposite ends of which are attached to barrels mounted loosely on the transverse shaft, one at the side of each beveled wheel. When the levers are drawn toward the operator, the barrels revolve the shaft through pawls and ratchets. The levers are brought forward by coiled springs placed within the barrels. The boat is steered from the feet, which rest on a centrally pivoted cross bar, to the ends of which the tiller ropes are attached.

The boat is easily steered, and can be as easily reversed, the work to be done by the occupant being continuous and always in the same direction, and since he faces forward, he is enabled to keep a good lookout ahead. Power as well as speed can be changed by attaching the straps higher or lower on the hand lever. These levers can be worked together or independently, and when additional power is needed, a second pair may be placed just forward of the machine, as indicated by the dotted lines. This apparatus is applicable to life saving boats, as it takes up but little space and is always in position ready for use.

Further information concerning this hand propeller can be obtained from the inventor, Mr. Michael Batz, of 357 Flatbush Avenue, Brooklyn, N. Y.

Progress of the Tehuantepec Ship Railway.

The Government of Mexico has lately made important additions to the concessions heretofore granted to the Tehuantepec Ship Railway. Mexico guarantees the net revenue of the Company to the extent of \$1,250,000 per annum for 15 years after the completion of the road, and gives the Company the right to ask for additional guarantees from other governments to the extent of \$2,500,000 per annum, or a total of \$3,750,000, being four per cent on \$93,000,000.

Other guaranteeing governments may have a rebate of 25 per cent. on their commerce for 30 years, and a representation of two-ninths in the Board of Directors. The Company has the right to establish coaling stations and to import coal free of duty, to furnish ships in transit, and also the right to collect all tolls, except those from Mexican commerce, in gold, a difference in favor of the Company of about 18 per cent. There are several other minor concessions granted, such as the right to establish two tow-boat lines independent of taxation, and to collect harbor dues.

IN our last issue we omitted to give credit to London *Engineering* for the illustrations of twin screw engines of the Italian ram Etna. We herein acknowledge our indebtedness.

MACHINE FOR SEWING LININGS IN HAT BODIES.

The machine represented in the accompanying engraving is for sewing linings or sweat bands into hat bodies. In arranging the sweat band and the hat on the arched bed plate of the sewing machine, the bed plate extends a short distance within the hat body, which hangs upon it, with the hat rim projecting upward in the rear of the presser. The sweat band, having its outer side uppermost, rests upon the plate with the binding projecting within the body, and going under and against the lip of a guide fixed upon the arched bed. One part of the lining extends underneath the longer arm of a guide lever fulcrumed to a movable plate fastened on the bed plate by a clamp screw. Pivoted to the rear arm of this lever is a cam lever, which, when turned against the movable plate, forces the opposite arm down upon the rear part of the lining; it also serves as an additional guide for the sweat band. The hat extends over the top of a feeder working through a slot in the bed plate. The machine is of the class that forms what is termed "chain stitch," sewing by means of a single thread, the mechanism for operating the needle and presser being such as commonly used in sewing machines of this kind. After the sweat band has been stitched to the hat and the latter removed, the band or lining is folded back within the hat body. The front guide fixed to the arched bed plate extends upward, and is provided with a guide lip to project from the inner edge of the guide over the binding of the sweat band and against that part which encompasses the rattan strip. This guide may be fastened to the movable plate, which would then be extended forward to the front end of the bed plate.

This mechanism is not for sewing a sweat lining and hat band to the body of a hat by one line of stitching, but is to fasten to the body a sweat lining of peculiar description. The lining is composed of a round strip of rattan or whalebone, a binding strip of glazed cloth or leather folded along its middle and about the rattan strip, and a broad piece of leather laid on the binding strip, to which it is connected by sewing going through both and alongside of the strip of rattan.

Paper and cloth linings can be sewed in with the machine as well as stitched, reeded, and raw edge leathers, and the machine will work equally well on any grade of straw, felt, or any other kind of hat. It is claimed that from seventy-five to one hundred dozen linings can be put in in a day of ten hours, according to the skill of the operator.

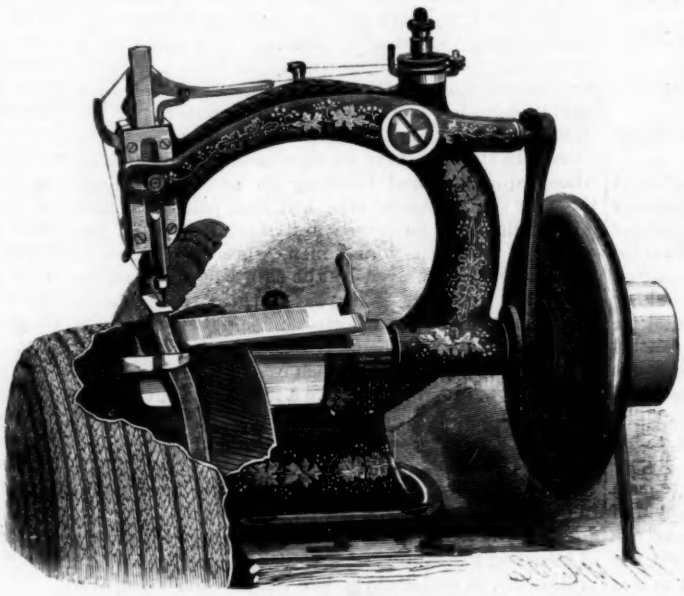
Further information regarding this machine can be obtained by addressing either the inventor, Mr. J. A. Locke, or Mr. B. H. Spaulding, both of Milford, Mass.

The Defenses of Holland.

A considerable sum is to be spent this year in completing the defenses of Holland. The system which has been adopted is peculiar, but is apparently well adapted to the characteristics of the country in which it is being carried out. While other nations, when invasion threatens, mobilize their armies, in Holland the order will be given for the "mobilization of the waters." When this operation is effected, a watery line from five to ten miles wide and some sixty miles long will be created, directly barring the advance of an invader coming from the east. Above the surface of inundation nothing will be visible but a few narrow roads raised on embankments, enfiladed by fortifications bristling with cannon. The water for the most part will be only a few inches deep, so that it will not be navigable by hostile gun vessels or flotillas; while deep trenches cut in the ground below will frustrate any attempt to wade through the inundation. The contingency of an invasion taking place in the winter, when the waters might be frozen over, is ingeniously provided for. The depth of the inundation will then be increased, and the waters allowed to freeze on the surface. The water below will afterward be drained off, leaving the crust of ice suspended, and ready to break in under the weight of the first troops who attempt to cross it.—*St. James's Gazette.*

A Large Photograph.

In the studio of Mr. D. J. Anderson, photographer, 785 Broadway, New York, is now on exhibition a photograph, which is 7 x 12 feet, and is a view of the interior of the 7th Regiment Armory, on the floor of which are grouped 800 full length figures, members of the regiment. It is a composition picture, each figure having been a separate study. It has occupied Mr. Anderson's time for the past sixteen months. Among those occupying positions as spectators are many well known in the civil and military world, including Grant, Arthur, Cleveland, Blaine, and others.



MACHINE FOR SEWING LININGS IN HAT BODIES.

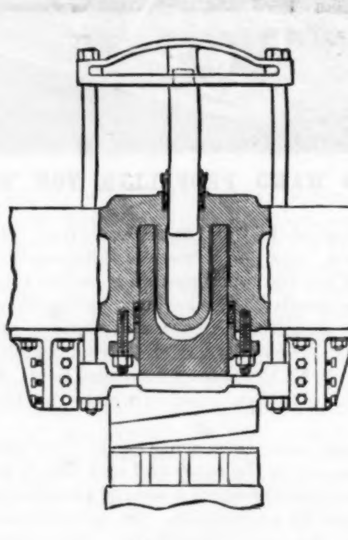
IMPROVED HYDRAULIC SHEARING MACHINE.

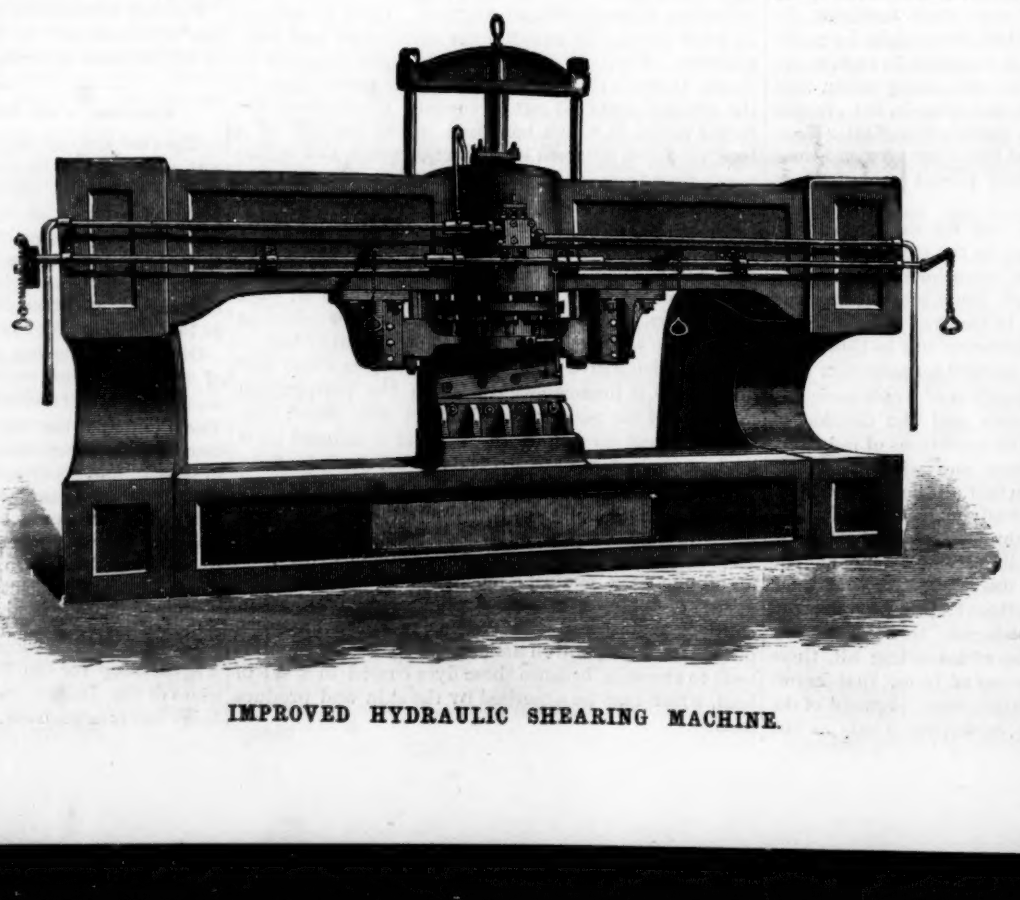
The illustrations represent a new form of hydraulic shearing machine, designed and constructed by Anderson & Gallwey, of Cremorne Works, Chelsea, for the rolling mills of Josse Goffin & Co., of Clabecq, Belgium. The machine is designed, says *Engineering*, to cut plates of 1½ inches thick, and by the arrangement of the framework, plates of great width and of unlimited length can be operated upon. For this purpose the frame is formed of two horizontal cast iron girders let into two end castings, between which a distance of 11 feet 16 inches has been allowed. The main cylinder, which is shown in action in the detail view, is cast in one with the top girder, and is bored out to receive the ram, which is secured to a crosshead carrying a shear blade and sliding in guides.

The ram is U-shaped in longitudinal section, in order to allow a second cylinder to enter the hollow thus formed. This latter cylinder receives the "drawback" ram, the upper end of which is fixed in a small crosshead rigidly connected with the crosshead carrying the blade, by means of two tie rods. The smaller ram is always in direct communication with the pressure water, and is therefore continually tending to draw the upper shearing blade away from the lower fixed blade. The pressure water is admitted to the larger ram, and exhausted therefrom, through two miter valves, the spindles of which pass right through the valve box. These valves are forced down on their seat by the combined action of the pressure of the water and of two spiral springs. The lower ends of the spindles bear on two eccentrics on a shaft running the whole length of the machine, and to this shaft levers for operating the valves are attached at intervals. The levers are connected by means of chains with hand rings in the way shown, and as they can be shifted to any position on the longitudinal rod, the machine can be worked from any point in its length. Upon pulling one of the chains, the eccentrics on the shaft open the pressure valve and close the exhaust.

When the ram has completed its stroke, a counterweight on the shaft brings the eccentrics into their former position, closing the pressure valve and opening the exhaust, when the pressure on the smaller ram draws the crosshead and the upper blade back. The machine is also provided with automatic tappet gear, by means of which the stroke of the ram can be adjusted to any length between ⅛ inch and 6 inches; the consumption of water being in direct proportion to the length of stroke.

Although the shears have to cut very wide plates, the length of the blades is only 2 feet 6 inches; this gives greater facility in straight cutting and also allows a curved line to be followed.





IMPROVED HYDRAULIC SHEARING MACHINE.

Fiber in Nails.

Unless cut nails are made from better material than is used generally now, their place in the market will be usurped by nails made from fibrous material. Wire nails are very favorably regarded, and are used in preference to cut nails on account of their superior tenacity, notwithstanding superior cost. The iron for cut nails, after being rolled, is slitted or cut lengthwise to a width adapted to the length of the nail to be cut. The length of the nails so cut is directly across the fiber which the iron has acquired by rolling, and, of course, shows its weakest where it should be the strongest. The ordinary cut nails will not drive into seasoned hard wood without "crippling," even under direct blows, and when the blow of the hammer is slightly on one side, they snap like clay pipe stems—they have no tenacity. The weakness of these nails is shown by the fact that it is almost impossible to straighten one that has been drawn from the wood, and then drive it again; in many or most instances, the nail will break in drawing.

On the contrary, the wire nails may be crooked into corkscrews, and then be straightened and be redriven. They are not only tough, but they are stiff, and will penetrate hard wood where the cut nail would break sharply off or hopelessly crook beyond restraightening. In every respect the fibrous nail is better than the crossent nail. If it could be afforded at the same or an approximate price, it would take the place of the ordinary cut nail.

Thought and Labor.

Ruskin says: It is a no less fatal error to despise labor, when regulated by intellect, than to value it for its own sake. We are always in these days trying to separate the two; we want one man to be always thinking and another to be always working, and we call one a gentleman and the other an operative; whereas the workman ought often to be thinking and the thinker often to be working, and both should be gentlemen in the best sense. As it is, we make both ungentle, the one envying, the other despising his brother, and the mass of society is made up of morbid thinkers and miserable workers. Now, it is only by labor that thought can be made happy; and the professions should be liberal, and there should be less pride felt in peculiarity of employment and more in excellence of achievement.

MIGRATION OF BLOWING VIPERS.

BY C. FEW SEISS.

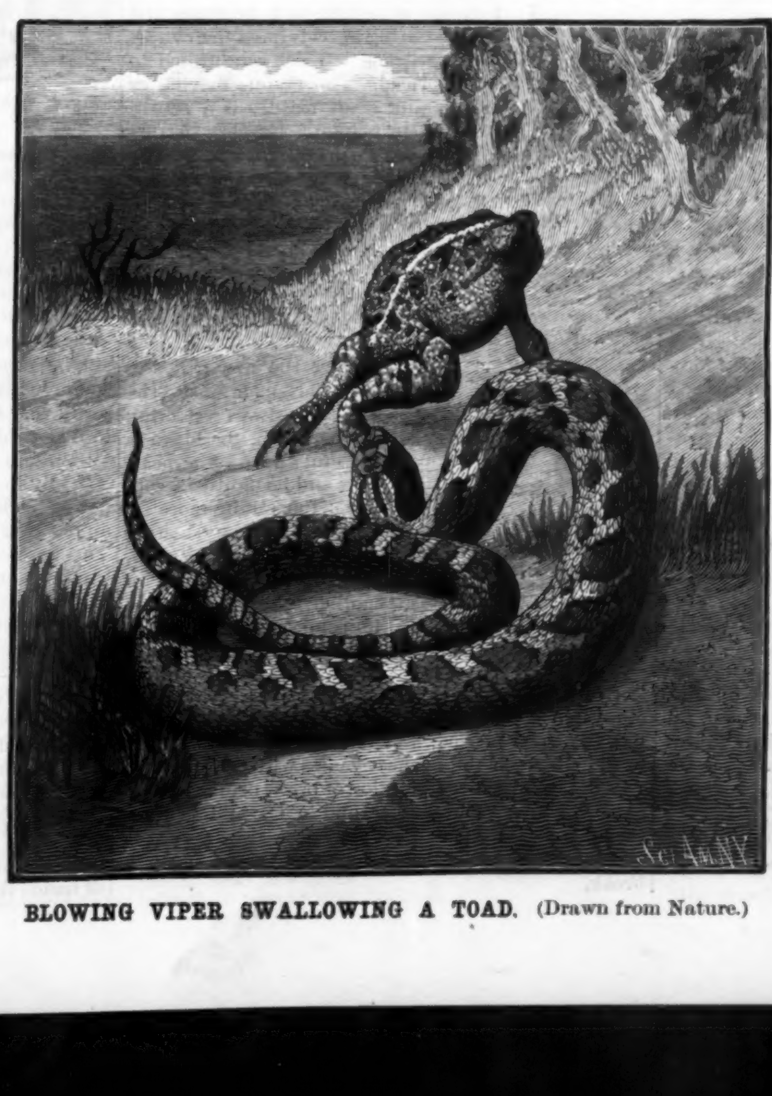
A few seasons ago, a narrow sandy island on the coast of New Jersey was overrun with countless numbers of the common toad (*Bufo lentiginosus Americanus*). The toad is generally of crepuscular habits, except during cloudy and rainy weather, but here they were met with, out in search of food, at all hours of the day, even beneath the hot glare of the noonday sun. It may be that, had they all waited until the cool of the evening to hunt for their insect prey, many of the weaker and less active toads would have been supperless. So, by hunting both by day and night, they were able to secure both diurnal and nocturnal insects. Over two hundred toads were counted in a short stroll between 4 and 5 o'clock in the afternoon of a July day. At this period there were no snakes of any kind to be met with on the island. That a few did exist I do not doubt, but they were not observed.

Now, this narrow island is separated from the mainland by a small bay or thoroughfare, which is perhaps over a quarter of a mile wide at its narrowest portion. The vegetation on the island consisted of little else than rank grass, stunted cedars, and pines.

In the season following the one above noted, the toads were again innumerable, but, what was startling, "blowing vipers" (*Heterodon platyrhinus*) were numerous also. They were observed in nearly every part of the island, and were seen pursuing, capturing, and swallowing the toads, as though bent on their extermination. Sometimes a toad would endeavor to escape by quickly burrowing into the sand, but the snake, having marked the spot where the toad disappeared, would force its head, with shovel-like snout, into the sand, seize the unfortunate toad, drag it from its hiding place, and swallow it.

What was the cause of this sudden appearance and number of snakes? They made their appearance in early summer, when the young *Heterodons* were not yet out of the egg, and it requires several months of growth before they are capable of mastering an averaged sized toad. Did they come from the mainland by swimming across the bay, which at its narrowest part is a quarter of a mile wide? This would seem like a great undertaking for a non-aquatic species, but, nevertheless, it is the only way in which they could have come. A migration of snakes has never before come under my notice, and yet I must consider this sudden appearance of "blowing vipers" as such. It is highly probable that food became scarce in their old haunts, and they migrated to the island in hopes of finding food more plentiful. It is not probable that their sense of smell is so highly developed as to have scented the toads from such a distance, and that they were quitting their old home with the certain knowledge that food in abundance awaited them on this sandy island.

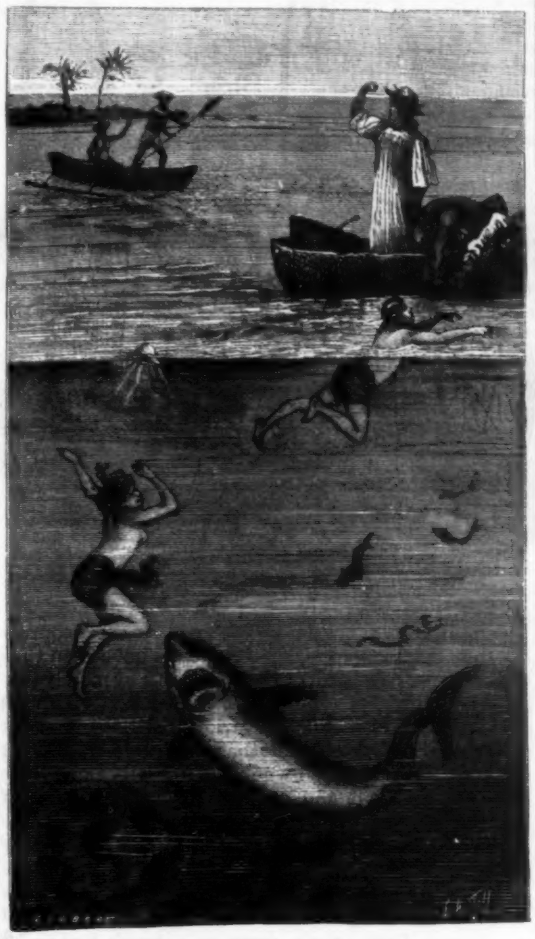
In the summer following this migration, toads were not numerous, and only a few snakes were observed; and such, I learn, has been the case for the two or three intervening years since then. Of course, great numbers of the snakes were killed by man; not because they were thought to be poisonous, for this species is here generally and correctly understood to be perfectly harmless nor always for mere wantonness, but from the belief that in destroying the snakes they were preserving the lives of many toads, which were beneficial to man, inasmuch as they fed upon mosquitoes. Now, the tormenting mosquito (*Culex damnosus*) is by far too small a species of game for the toad. I have examined the contents of the stomachs of several maritime toads, but failed to find mosquitoes. Very young toads, which have just left the water and the tadpole stage, do feed upon minute insects, such as gnats, ants, aphides, etc., but I refer only to the mature animals.



BLOWING VIPER SWALLOWING A TOAD. (Drawn from Nature.)

MOTHER-OF-PEARL.

The principal production of Tahiti is mother-of-pearl. This is what stimulates her commerce, this is what gives rise to the relatively important exchanges that take place in these far-off lands of Oceanica, and this is what attracts those vessels which, for a century past, have been sailing among the desolate and wild islands



PEARL FISHING IN TAHITI.

that make up the archipelagoes of Tuamotu, Gambier, and Tubuai.

On account of its rarity, mother-of-pearl has always been an object of luxury. Before navigators discovered that part of the world which is lost in the immensity of the Pacific, it was still rarer than it is now; it had more value, perhaps, but it was assuredly neither more sought for nor more prized. At present it is much employed in the manufacture of many objects. The mother-of-pearl employed in the industries is furnished by various species of shell-fishes, the most esteemed, most iridescent, and also the most beautiful being that produced by the pearl oyster. Again, two sorts of pearl oysters are distinguished. One of these, known as the pintadine (*Meleagrina margaritifera*), is found in China, the Indies, in the Red Sea, off the Comore Islands, to the northwest of Australia, in the Gulf of Mexico, and particularly off the Tuamotu and Gambier Islands.

The other, which is more commonly known as the pearl oyster (*Meleagrina radiata*), is found in the Indies, in the seas of China, in the sea of the Antilles, in the Red Sea, and to the north of Australia.

The former of these has a harder, more azure, and more transparent shell, and one that attains larger dimensions than that of the latter. Some have been found that measured as many as 12 inches in diameter and weighed more than twenty pounds. The *Meleagrina radiata* rarely exceeds 4 inches in its largest dimensions, and never reaches a weight of five ounces. The two species furnish pearls. According to the fashion, or the prevailing taste, sometimes those of the one are preferred and sometimes those of the other; nevertheless, those of the pintadine have a brighter luster and more transparent and intense tones than those of its congener.

It is difficult to estimate the money value of the pearls collected in the French possessions of Oceanica. We cannot even fix upon an approximate figure as regards this, since this commerce escapes all control, and proceeds after a manner clandestinely. Some estimate that it reaches about $20,000 per annum, and others that it amounts to $100,000. According to what I have seen in the Tuamotu Islands, and, on another hand, considering the quite large number of persons who, at Papeete only, are concerned in this trade and live by it, I would give it as my opinion that it amounts to $60,000. The most important markets for fine pearls are found in England.

The pintadine comes from the tropics. The archipelago of Tuamotu and Gambier is, as I have stated, the point where it is found in the greatest abundance. Here it finds surroundings that are congenial to it.

This archipelago, which was annexed at the same time as the islands of Tahiti and Moovea, consists of eighty islands, almost all of which yield mother-of-pearl, and seventy-two of which are inhabited intermittingly by individuals of the Maori race. France has an excellent and devoted population there, which is very proud of its new nationality, and which remains indifferent to all attempts made against our influence. It loves France, proclaims the fact, and manifests it loudly every time that occasion requires it. Industrious, docile, submissive, of mild and simple manners, observing with scrupulous fidelity the laws and regulations that have been given it, it is one of the poorest on the face of the globe. The narrow tongue of land, or rather the crown of arid reefs that surrounds the lagoon of these coral islands, and which is destitute of vegetation, scarcely affords this people sufficient food for its miserable and precarious existence. While the neighboring happy population which dwells upon the fortunate shores of the Society Islands leads a life of ease and pleasure, where everything grows without labor and in abundance, the unfortunate Tuamotun is reduced to the necessity of feeding upon the cocoanut and a few rare and meager seeds of Pandanus (nearly the only fruits on these sandy shores), fish, and shell-fish, which, during several months in the year, are poisonous.

The Tuamotu people are essentially nomadic—through necessity as well as through taste. When one lagoon is exhausted, when diving no longer yields anything, the native, without sorrow or regret, or without caring even, places his family and his goods in his boat, abandons the hut that he had built, and goes, somewhat at the will of the winds, to seek elsewhere, in another island, the wherewith to live. His only industry is diving. All take part in this—women as well as children. The women have a truly wonderful aptitude for this arduous and laborious occupation. At Anna there is a woman who explores depths of 25 fathoms, and sometimes remains under water for three minutes, and she is not an exception. And, then, how dangerous are these investigations in the dark depths of the lagoon, where reign as masters hungry sharks, which, when they cannot be avoided, must be fought! There does not pass a year in which some diver does not come out of the water mutilated. When an accident happens, terror reigns among the divers, and the fishing for mother-of-pearl ceases for some days. But this feeling of fear and of danger does not last, for it becomes necessary to give way to the imperious needs of life. To the Tuamotun, mother-of-pearl is current money. It is with this that he buys the scanty clothing that he wears,

and the little bread, flour, and provisions that he eats, and, finally, the alcohol for which, like all the inhabitants of Oceanica, he has a pronounced passion.

The picture which I have just sketched is exempt from all exaggeration. I cannot enumerate the sufferings of these brave people who are so attached to us, nor the vexations that they have been subjected to on the part of trafficking strangers.

Twenty or thirty years ago the trade in mother-of-pearl in the Tuamotu Islands well paid those engaged in it. By means of a bit of valueless fabric, a few handfuls of flour, or a few pints of rum, there was obtained a ton of mother-of-pearl, worth two hundred or four hundred dollars, or many beautiful pearls whose value the natives ignored.

The archipelagoes were frequented by boats of various nationalities. Mother-of-pearl was abundant, and pearls were not so rare as at present. Since then the number of trading vessels has increased.

The aborigines, enticed by the advantages of a commerce that was becoming more and more fruitful in measure as competition extended, betook themselves to fishing with improvident ardor, and now they find that the lagoons are less productive, that they are becoming depopulated, and that some of the most fertile of them are giving signs of exhaustion.

The interesting situation of the population of the Tuamotus, the danger by which it was menaced of being deprived of all resources and of all work, and also the fear of soon seeing one of the most productive sources of revenue of the Tahitian colony exhausted, and the principal element of its commerce disappear, attracted the enlightened attention of the colonial administration. With an eagerness that the Colonial Council of Tahiti has had to thank him for, the Under Secretary of State had the goodness to select me to go on a mission to Oceanica. The programme of studies he gave me was as follows:

(1) What is the real state of the oyster producing lagoons? Are they beginning to give out? If so, what is the cause of it, and how can it be remedied? (2) Would it not be possible to create an industry for the culture of the pearl oyster at the Tuamotu, Gambier, Tahiti, and Moovea Islands analogous to that which exists in France for the culture of the edible oyster? Would it not be possible by this means to procure remunerative work for the indigenes of Tuamotu, and one that should be sedentary and continuous, and that would render them independent and free them from the cupidity of dishonest traders, whose dupes and victims they are? Would they not thus be preserved from the trouble and danger that result from the assiduous practice of diving? Would it not be a means of attaching them to their home, their family and native island, prepare a more peaceful life for them, and gradually lift them toward the social level of the peoples of ancient civilization? (3) Is there any way of regulating the fishing for mother-of-pearl in the archipelago? If so, what should be the bases thereof?

Although statistics do not show a great diminution in the production of mother-of-pearl, it results from the minute investigation that I made upon the very spot that the lagoons are becoming poorer and poorer every day, and that in order to secure oysters of merchantable size the divers are obliged to visit great depths. I estimate that if we do not take prompt and vigorous measures, the lagoons of Tuamotu will run the risk of being very much impoverished, if not ruined, in a few years. The arrangements applied by the administrators who have succeeded one another at Tahiti were assuredly excellent, but they were insufficient to avert their ruin.

The forbidding to fish in a certain number of islands for a few years, so as to favor their regeneration, could not produce such a result, since, contrary to what has been thought, the pintadine is not unisexual, but hermaphrodite. The cause of the impoverishment of the lagoons is due to the abusive and improvident fishing that has been done in them.—*G. B. Brandley, in La Nature.*

THE *London Iron Trade Exchange*, on the tin plate trade, says: "Competition is as keen as a razor, and business is only made at the meanest profit."

Training Cavalry Horses.

Major W. K. Arnold, of the Sixth Cavalry, stationed at Fort Bayard, New Mexico, has undertaken the training of the horses used in his service, so that they will lie flat on the ground on command of the trooper. The result of his experiment has proved very encouraging thus far (about twenty-five horses have been thus trained), and nearly all of them lie down by merely taking hold of the left fore leg. The men can climb all over their bodies, and fire in various positions, without the horses stirring. Another desirable result of this training is that men who were formerly timid have become courageous and confident in the handling of their horses, and horses formerly dangerous are now thoroughly gentle. Army officers have become very much interested in the matter, and it is not improbable that more extensive experiments will be made in this direction. The value of a large body of men mounted on animals that will lie down at a touch and suffer guns to be fired over their bodies in action is apparent.

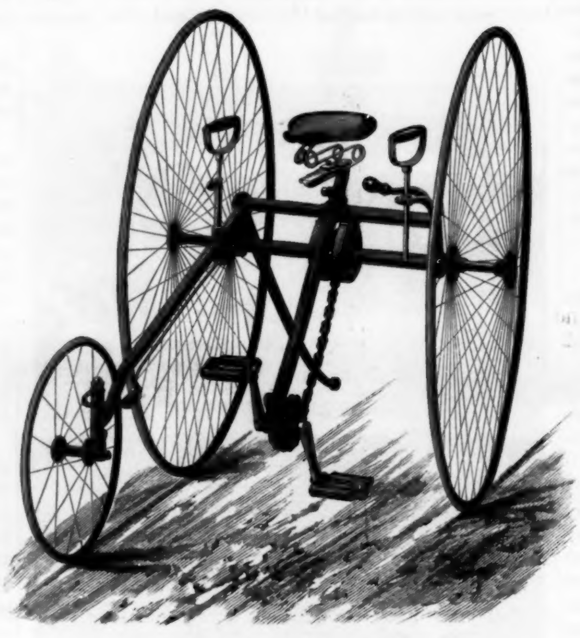


Fig. 1.—COLUMBIA TWO-TRACK TRICYCLE.

THE COLUMBIA TWO TRACK TRICYCLE.

The Columbia two track tricycle, of which we show a perspective view and also views of the more important characteristics, will present many points of interest to those who have studied and compared machines. It has been designed and made after careful study of every detail, and although many improvements have been adopted, it still contains all those details which extended use in the older machines has proved to be particularly applicable to the services required; thus the adjustable ball bearings and compensating swivels have their superior excellence too well established to be displaced. The middle driving or short crank shaft feature is a return to an old principle of tricycle construction which has at times been displaced for necessities of other parts or fashions in structure, but which, for steady effectiveness and lightness in this machine, is believed to be the best. The two track feature, though not broadly new, has been here embodied with improvements, so as to give equal steadiness of running and the stability of front steering, with the advantages of an open front for convenience, and but two lines of resistance to the wheels to watch and overcome. Among the new features may be mentioned the Wallace dwarf steering head, which, besides its graceful and neat appearance and its lightness, conducts the strain more directly from the steering wheel to the driving gear, and insures steadiness of motion; the spiral rack and its connections, by which the steering apparatus is made most simple and effective, and is most out of the way and least subject to disarrangement; the three part frame, which affords just the parts needed, and no more; the double hand brake, which combines effectiveness with certainty and ease of action; the combination of brake drums, sprocket and balance gear together, and in the middle under the seat; the large, weldless, steel tubular axles in place of solid shafts, which are heavier and more likely to break.

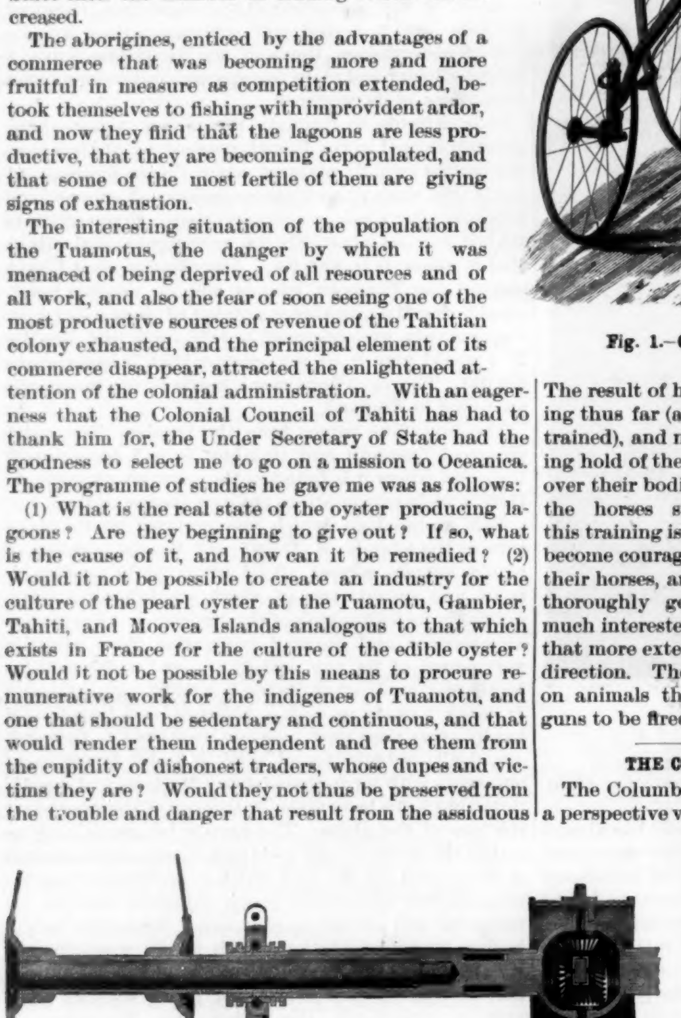


Fig. 2.—SECTION THROUGH AXLE.

Fig. 3.—SEAT.

The inclined seat rod operates to move the saddle backward also, when it is raised, so as to preserve the relative positions of seat and pedal, for the taller rider has a longer upper leg as well as lower leg; and by an ingenious attachment of the crank supporting tube, tangent to the horizontal one instead of flush with it, as usual, this seat rod is made to move in and out free of everything. Another and most valuable new departure is the building of the wheels directly upon the tubular half axles, thus obtaining a firm wheel, a safer axle, and dispensing with a large amount of misplaced material. These and other improvements have reduced the weight of a tricycle more than twenty pounds, while adding to its strength. The driving wheels are 48 in., and the steering wheel, tracking before the right hand driver, is 20 in.

The Columbia two track tricycle is made by the Pope Manufacturing Company, of 597 Washington Street, Boston, Mass.; it will be placed upon the market about the middle of April.

Skate Rollers.

"In less than one year the price of boxwood has trebled," said a hardwood dealer. "The roller skating mania has completely exhausted the market of a certain size of boxwood. Less than eighteen months ago I could sell a ton of three inch boxwood for $38, and it would be first grade wood in every respect, and admirably suited for turning small work. The demand then was steady, and the principal consumers of the wood were rule makers, tool manufacturers, and turners, who supplied the market with boys' tops, pool pins, and toys of various kinds. The sudden and remarkable growth of the roller skating pastime has created a constantly increasing demand for a certain size of wood, and now it is impossible to purchase a ton of suitable wood for skate wheels for $120. Rollers are made in several sizes, ranging from 1⅝ to 2¼ inches in diameter, and only the natural growth of boxwood approximating these sizes is fit for use. Large wood is too costly, and is less firm in resisting the tremendous strain of a skater's weight upon an axle only 7-32 of an inch in diameter. The boxwood grows in Persia and Turkey, and heretofore the crop has always been handled in England. It is a wood of very slow growth, and in its native country stringent timber laws restrict the depletion of the growing trees. At the present rate of consumption, the world will be practically exhausted of its boxwood in less than twelve months unless some equally cheap and durable substitute is found to take its place."

Fig. 4.—STEERING WHEEL.

"Has nothing been tried which gives promise of superseding boxwood?" asked the reporter.

"Yes, rubber, celluloid, rawhide, vulcanized fibers, and compressed paper have been tried in making rollers, but for one reason or another they have proved unsatisfactory. Some have proved too soft, while others, like the pure celluloid wheels, have been found too expensive for general sale, and the necessary metal bushings have proved objectionable, because the grit and dust from the floor and shoes of the skaters, wearing between two metal surfaces, has rapidly cut away the axles of the skates. Rollers with anti-friction bushings consisting of a number of small steel plugs freely revolving around the axles have been tried with some composition wheels with success, but they are necessarily very expensive, and on this account cannot come into general use."

"Will no other wood than boxwood answer?"

"Only for very cheap skates. Dogwood, apple, pepperidge, laurel, and lignum vitæ have been tried by almost every roller maker; and all have been rejected. The lignum vitæ alone is hard enough, but it will not stand the strain of the small axle. Metal wheels with a rubber surface are made, but nothing has yet been found which in all respects is as good for the purpose as boxwood."

PEOPLE who use warm water bottles and India rubber bags would find a bag of sand far more convenient. The sand should be fine, clean, and thoroughly dried, then put into a flannel bag, and the bag covered with linen or cotton cloth, to prevent the sand from sifting out. The bag may be quickly heated by placing it in an oven or on a stove. The sand holds the heat a long time, and imparts a more agreeable warmth to the feet or hands than a warm water bottle.

THE RUDDER OF THE ALASKA.

We continue from our last number the contributions of various correspondents on this subject.

To the Editor of the Scientific American:

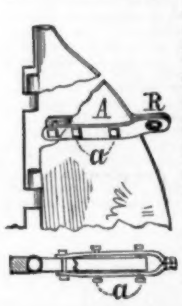
In your paper of the 7th of March, you give a description of broken rudder of steamship Alaska, and ask for plans for repairing same, so as to make it steer the ship. My plan would be to take two pieces of hard wood timber, say 6x8 and six feet long, and placing one on each side of the rudder, to bolt them across the break, with, say, four large bolts passing through the break as near the edges as they could be placed. I would do this, provided, of course, that it could be done. I do not understand the construction of large steamers, and do not know if the rudder can be gotten at so as to attach anything to it; but if it can be reached, two pieces of hard wood placed as above, and strongly bolted, would, I think, be sufficiently strong to steer the ship. The helm could not probably be put "hard up," but it could be moved sufficiently far for all practical purposes. I inclose a single drawing of my idea.

GEORGE Q. PEYTON.

Rapid Ann Station, Va.

To the Editor of the Scientific American:

I read with much surprise that the officers (particularly the engineering department) did not devise the very simple expedient of making fast the broken part of the rudder of the steamship Alaska, and connecting the same by chains, as shown in sketch. Those not accustomed to sea life would say at once no person could live for a few hours with the sea running so high.

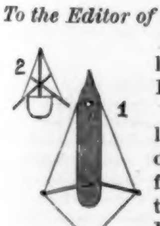


I say a determined spirit could accomplish such a feat. In proof of the above assertion, I was, during our late war, in a small blockade runner with a valuable cargo. During a heavy norther in the Gulf of Mexico, the key in the propeller came out (having no key through the hub), rendering us helpless in a heavy sea. A drag was got overboard, which held her somewhat quiet, but with heavy seas breaking over, when she would fall off. I decided at once, and acted as follows: Being securely made fast, I was lowered over into the water with the proper tools, took the size of the key, watching the opportunity was hoisted on deck, and in a few hours had a rough key fitted and driven in under water, which took us out of trouble, and got in safely. I merely illustrate this to show what can be done. Now for the Alaska's case; if there could have been no attachment made to the part marked A, then make a clamp similar to the sketch; as will be seen, there is room for a through bolt on the end, *d*, with the proper set screws marked, *a a*, and a 2 inch hole at R, where could be got the proper leverage and chain connection over the quarters. A quick and temporary arrangement, which would have enabled her to proceed on her voyage. I am also astonished to find there were no eyebolts in the afterside of the rudder, as is usually the case with almost all iron rudders, and would have saved time, money, and anxiety.

H. L. STIBBS.

New Orleans, March 9, 1885.

To the Editor of the Scientific American:



Not knowing what material they had on board the steamship Alaska, I should have done the following:

When main and fore yard-arms lashed, one end to the mizzen lying over the guard; from two windlasses forward attach a cable to each one of the yards, forming a bridle, diagram, Fig. 1, and supporting, as Fig. 2.

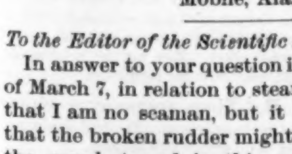
The drag made out of the two topsail yards, using chain, would sink them sufficiently.

T. B. FOSTER.

Mobile, Ala.

To the Editor of the Scientific American:

In answer to your question in SCIENTIFIC AMERICAN of March 7, in relation to steamship Alaska, would say that I am no seaman, but it at once occurred to me that the broken rudder might have been dropped, and the vessel steered in this way: Of course they had plenty of heavy timbers and bolts, ropes, and large cable chains. I would have made a heavy timber frame like this, say perhaps 20 feet long and 5 feet wide in middle by 1½ feet thick, with the opening cut just large enough to let it slip on to the rudder just below where it was broken on top. Two heavy cables could have been attached to each end, and four ropes fastened to suspend and hang it by. All this could have been done on deck, and when ready it could have been swung over the stern and lowered to any position, and when the rudder came straight for a minute, it could have been drawn on. The two cables could have been carried to each side of the vessel and through portholes, and connected with one or two windlasses. As soon as the timber was slipped on to the rudder and the cables tightened, the back of the mortise would have struck the edge of rudder, and the timber would have at once pinched the two sides of the rudder so firmly that no force of waves could have removed it as long as the cables kept it under proper tension; by turning the windlass either way, the rudder could have been swung to port or starboard, and the Alaska been steered and saved the $200,000.



GEORGE H. BARTLETT.

Madison, Wis., March 9, 1885.

To the Editor of the Scientific American:

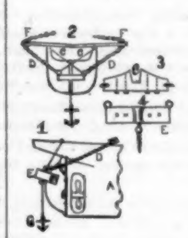
I read with great interest your account of accident to steamship Alaska in issue March 7, and in accordance with your suggestion I send sketches showing a device I would have suggested had I been on board at the time. Should you deem the method a feasible one, and publish same, I desire to have it first distinctly understood that I am not a sailor, and in my description may use decidedly *unnautical* terms or names.

Fig. 1 is a side view.

Fig. 2, a stern view (or supposed to be).

Fig. 3, top view of grabber (or whatever you may call it), E.

Fig. 4, rear view of same.



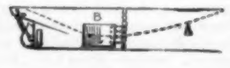
I would in the first place have the strongest pieces of timber available, made in the form of E, having a tapering notch, *e*, and strengthened with straps of iron and provided with eyebolts, as shown, one on each end and one on lower side of center. As far forward as possible, on each side, I would place as far out as necessary two outriggers, F, either rigged with pulleys over which to pass steering chains, D, if such pulleys were available from the steering gear, or if not, then pass steering chains over swinging booms set at proper angle, attach steering chains to each end of piece, E, then from starboard end of E pass a hawser, *c*, to larboard side of ship, and make same fast as near as possible to a line swung through center of rudder athwart ship, and also attach hawser, C, in a contrary manner. Attach an anchor, G, to the center of eyebolt, and of sufficient weight to keep piece, E, firmly down on the rudder, B. After all parts had been securely made fast on deck, I would cast the rigging over the stern by means of outriggers or boat lowering apparatus, then steam ahead at full speed, so as to throw rudder fairly astern, and lower the rigging over the sound part of rudder, as shown, so that notch, *e*, passed over sound part of the rudder.

GEORGE B. FOOTE.

Helena, Mont., March 12, 1885.

To the Editor of the Scientific American:

In answer to your question, what one would do in such a case, the Alaska's broken rudder, I beg to say, first, I would "bind up" the broken rudder, and go about it thus: Cut a good sized hole through the counter, one on each side of the rudder post; have two iron hooks long enough to reach (one through each hole) to and *through* the recess in the rudder at that part where the screw shaft ends. Then pass a cable chain over the starboard side, as near the rudder post as possible; let the man at the starboard counter hole catch the end with his hook and bear it to the recess, and the man at the port counter hole pass *his* hook *through* the recess and take it from him, and a man over the port rail take it from *him*, and pass around the stern so it will fall over the wider part of the rudder, and carry the end to the starboard side, well astern; at the same time the starboard end is being carried to the port side, and as they pass, a twist or bight is given the chain, this bight to be well shaken down, so it will grip the wide part of the rudder, which will keep the rudder from doing injury to the screw, and might do some service in steering.



While this was going on, I would be having made some boiler iron pins thus: Take a sheet of boiler iron, fold it like a sheet of letter paper. Make two of them, one for the starboard and one for the larboard, with holes in one end of each, and one or two holes in the other ends. Attach them to a chain cable in such a position that when the cable is placed in its position the fins will be under water. The fins are to be fastened to the cable by means of reeving a smaller chain through the eyeholes of the fins and links of the cable, and in the other end of the fin will be fastened a hawser guy, A, to work it. Now, the cable is to be long enough to pass around the hulk.

When the details are completed, the bight of the cable is to be lowered over the stern of the vessel; the bight allowed to slip along the keel to some point no farther forward than to have a good place for the fins, B, to hug the side of the vessel; then draw the cable tight and run the guys, A, forward and take a snubbing turn around the capstan. There should be a check guy to the fins, to keep them from beating about in a dashing sea.

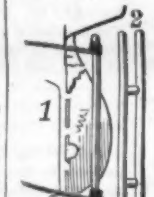
I have not seen the ocean for thirty-five years, about which time I had made several little trips, one around Cape Horn. I do not forget its audacity.

R. G. NORTON.

Madison, Wis., March 7, 1885.

To the Editor of the Scientific American:

I submit a rough sketch of plan that might be used to secure ship rudders broken in the manner of the Alaska's.



Two pieces of timber or spars are secured together with cross pieces to separate them far enough to admit the rudder; hawsers are attached to both ends of the spars on each side. Now, if the spars can be placed over the rudder and held there, the vessel may be steered. If the lines interfere with the wheel, of course the sails would have to be depended on. There are details that could be worked out according to the circumstances.

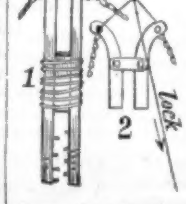
S. A. BROWN.

Buffalo, N. Y.

To the Editor of the Scientific American:

You invite your readers to present a feasible remedy for an accident to a vessel's rudder similar to that of the Alaska.

As a temporary arrangement that could be made with the most dispatch, I would suggest two pieces of timber, pieces of spar, or, if obtainable, square hard wood; lay side by side, with a block the thickness of the rudder between; wrap with rope. At the ends an eye could be affixed and chains attached, to be carried through hawse holes or on deck, and operated with a windlass. Pins put in the end that clasp the rudder would, I think, penetrate the iron and tend to hold it in place, and by keeping a strain on both sides would keep a firm grip on the rudder. Should that appliance show signs of giving way, the shipsmiths could in the mean time have made a grip after the fashion of a pair of icetongs (Fig. 2) or blacksmith's, and applied the same way. A wedge could be inserted in the outside of the wooden arrangement, and driven in by a hanging weight from the stern of the vessel, the rope winding being continued far enough up to hold it in place.



I think the arrangement could be got into place by means of guys from the side of the boat.

E. TAYLOR.

Lung Disease in a Lion.

Mr. Abraham recently exhibited before the Academy of Medicine in Ireland the left lung of a lion which had been born in the zoological gardens, had lived there twelve years, and recently died. The animal had had good health until October 1, when there was sudden cold weather. The lion refused food, seemed feverish and thirsty, and his respiration became exceedingly rapid. He appeared to have pleurisy, his chest being fixed and his breathing abdominal. An attempt to administer medicine failed. He took little food, except occasionally. He drank some niter in water, with diuretic effect. He had no cough, but two or three times he spat mucus, which toward the end became bloody. Ultimately, he became emaciated, and died. His viscera were healthy, except the lungs. There was no pleurisy, but the lungs were diseased, mottled in appearance, and hard and lumpy to the touch. On section, they presented a curious honeycombed aspect. The bronchial tubes were enormously enlarged. In the lower lobe of the left lung was a large cavity. The microscopic sections of various parts of the lung did not show the structure of tubercle, nor did any of the bronchial glands. He was not sure what the disease was. The father of the lion died in precisely the same way.

Mr. Baker remarked that lung disease was common among cats, which frequently suffered like the lion in question.

The President observed that monkeys were subject to consumption. In the lion's lungs exhibited, he had no doubt the cavity existed for years, and a small amount of cold sufficed to kill one of the large carnivora.

Mr. Abraham said that, long ago, Dr. Haughton discovered that tubercular phthisis was not so common in monkeys as was generally thought, and he showed it in a paper read many years ago before the old Pathological Society; and in a paper read before the Zoological Garden of London, Mr. Sutton recently came to the same conclusion.

ENGINEERING INVENTIONS.

A steam actuated valve has been patented by Mr. Walter S. Phelps, of Wortendyke, N. J. This invention consists in the combination, with the steam cylinder and pistons, of a steam chest containing a series of pistons operated by the live steam in the cylinder at the end of each stroke, which live steam, after being admitted into the chest, works under expansion and shifts the pistons.

A railroad rail joint has been patented by Mr. John A. Foley, of New York city. According to this invention, the joints are made by the adjacent ends of rails having the ends of their bases square, and the ends of their webs and heads beveled and projecting beyond the square ends of the bases, and connected by fish plates and bolts and nuts, to form a smooth joint and prevent hammering of the ends of rail heads by the car wheels.

AGRICULTURAL INVENTIONS.

A potato-digger has been patented by Mr. Samuel Huber, of Danville, Pa. The standard has side plates braced to a central shoe, and there are shares secured to the side plates, with lugs upon their lower sides and upwardly curved rear corners, making a digger which runs very steady in the ground, is easy to hold, and is very cheap and durable.

A weeding and thinning device for growing plants has been patented by Mr. James N. Stevenson, of Salvisa, Ky. This invention consists in a hand implement of tongs-like construction, with two cross limbs pivoted, the forward portions of which have lips arranged to face each other, preferably faced with rubber or flexible material, and the extreme end of one limb having a cutting blade.

MISCELLANEOUS INVENTIONS.

A faucet has been patented by Mr. Nicholas Styne, of Brooklyn, N. Y. This invention covers a special construction and arrangement of parts to promote convenience and reliability in the use of faucets, and to facilitate taking them apart for repacking and other repairs.

A can opener has been patented by Mr. Caleb S. Lobdell, of Stormville, Miss. This invention consists in various parts and details forming a new and improved apparatus to be used for cutting out the tops of cans, the blade making a clean circular cut along the edge of the top of the can, or cutting out a smaller opening if desired.

A stump puller has been patented by Mr. Peter Hansen, of Waupaca, Wis. This invention covers a peculiar construction and arrangement of parts in a lever device for the pulling of stumps and small trees, and to promote simplicity in the construction, convenience in the use, and efficiency in the operation of stump pullers.

A rubber heel has been patented by Mr. Henry V. Deemar, of St. Charles, Mo. It has in its sides a groove, forming a tongue at the top edge, the heel being passed through an aperture in the heel part of the sole, and the tongue of the heel held therein, thus making a heel which is very elastic and springy, strong, and durable.

A water elevating bucket has been patented by Mr. Christopher C. Coffee, of Memphis, Tenn. It is formed of a body blank and two side blanks, the side blanks having wings which form the front of the bucket, the blanks being made of small pieces or scraps of sheet metal, but united in series to form a bucket chain for elevating water.

A shoe lace fastener has been patented by Mr. Charles J. Johnson, of Lone Pine, Cal. The invention consists in the combination, with a plate, of a lever pivoted thereon, and having an aperture, and with a hook on its free end, with a link pivoted on the plate, for the purpose of holding the free end of the lever to the plate, to hold securely the ends of a shoe lace.

A thermo-electric battery has been patented by Mr. Daniel Lautensack, of Vienna, Austria-Hungary. The object is to make a more durable battery than at present made with the antimonial alloys for the positive electrodes, so these electrodes are cast on a core of tenacious metal covered with an insulating coating, the core also serving as the negative electrode.

A gate has been patented by Mr. George C. Milgate, of Folsom, Cal. This invention covers a peculiar construction and arrangements for the making of a gate by the use of certain levers pivoted in the posts, so that by pulling one cord the gate may be entirely folded up, or by pulling another cord it will be unfolded in its proper position.

A sealskin sack, dolman, and ulster block has been patented by Messrs. Phillip Weinberg, Louis Clark, Jr., and Egbert Winkler, of New York city. It is made of two boards secured to each other at an angle at their forward edges and recessed at their angle and at the rear edge of the front board, so that by its use the labor of making the garment will be lessened and a better shaped garment will be produced.

A hydrant has been patented by Mr. George A. Warner, of Des Moines, Iowa. This invention covers a special construction and arrangement of parts for making a new and improved hydrant, the valve for opening and closing the passage from the service pipe consisting of a stuffing box with packing rings of suitable material, and the device including many novel features.

A composite tiling, paving, and flooring slab, or building block, has been patented by Mr. Robert Marsh, of Brooklyn, N. Y. It is composed of Portland cement, asphaltum concrete, or other suitable artificial stone or cement material moulded in conjunction with pieces of tiling, glass, or other suitable material embedded in its face, for ornamenting the slab or block or forming a part of the main body thereof.

A ladder has been patented by Mr. James M. Trimble, of Sedan, Kan. It is of that class which are adapted to be extended or retracted at will, and made portable, more particularly for the use of firemen, and the ladder may be wound upon a reel or extended therefrom, and its joints be automatically secured in the act of extension or released in the act of retraction.

A spring motor has been patented by Mr. Matthias H. Howell, of Jersey City, N. Y. It has a tubular spring wound on a drum, with one end secured to the drum and the other end to a disk or wheel for winding it, the disk being rigidly mounted on a shaft, and having clutch dogs or pawls for locking it in place, the motor being designed for sewing machines, gig saws, fans, etc.

A power hoist has been patented by Mr. Charles W. Baldwin, of Denver, Col. Combined with a hoisting drum is a shaft, to be operated by hand or steam power, with means for revolving the drum from the shaft, there being also a brake pulley and clutching devices for automatically engaging it with the drum, with other novel features for raising buckets, elevator cages, etc., out of wells and shafts.

A fire place and chimney have been patented by Mr. Theodore C. Nativel, of Oakland, Cal. The fireplace is made of horizontal sections of burnt clay made in semicircular form, with tongue and grooved joints, and is combined with a chimney and ventilating flue made up of circular sections of burnt clay, with tongued and grooved joints, and having peculiarly constructed ventilating hot air chambers.

A folding book and paper rack has been patented by Mr. Marion E. McMaster, of Shelbyville, Mo. The invention consists in a special construction of the supporting end brackets of the shelves, so they can be folded compactly with the shelves when not in use, the paper rack being below the book, and its brackets being constructed for support from the book shelf pivots.

A rudder attachment has been patented by Mr. William Johnson, of East Moulsey, Surrey, England. This invention provides a rudder attachment for small boats, which, while securely holding the rudder in position, will allow it to rise without becoming absolutely unshipped in case it comes in contact with the ground, while the rudder can also be shipped and unshipped with facility in any position.

A finger ring has been patented by Mr. Robert A. Kullmann, of Jersey City, N. J. This invention consists principally in forming the ring with a screw threaded socket or stud, and in providing a face screw adapted to pass through the initial or ornament and screw into the screw threaded socket or stud from the front of the ring, so that initials or ornaments may be easily attached to rings to suit customers.

A knife for miners has been patented by Mr. George Freund, of Durango, Col. This invention covers an improvement on a former patented invention of the same inventor, and combines with a knife casing, a can opener, a cork screw held in the blade for splitting or cutting the fuse, and various details and parts of construction for an improved miner's knife.

A water closet has been patented by Mr. August F. Blesch, of Columbus, Ohio. This invention covers improvements on former patented inventions of the same inventor, and consists in improved means for lifting the main discharge valve of the closet by a piston working in a cylinder, and controlled by a valve opened by a rise of the seat spindle, with other novel combinations and special features of construction.

A lady's tricycle has been patented by Mr. Louis P. Valiquet, of Mount Kisco, N. Y. This invention consists of a frame in the side arms of which the axle carrying the clutches is journaled, and of the three armed foot levers connected to arms of the frame and to the clutches, the advance of the tricycle being checked by pressure applied to the clutch casings, with other novel features, so these vehicles can be conveniently ridden and operated by ladies.

A fascine binder has been patented by Mr. Abraham M. Kanters, of Buffalo, N. Y. This invention covers a binder with a series of horses or supports, with cross bars to support the brush wood, with pivoted clamping levers, and other novel features, by which such bundles as used in the construction of jetties, dams, breakwaters, or other engineering works may be compressed and bound with economy of time and labor.

A banjo has been patented by Mr. William B. Lomas, of Brooklyn, N. Y. In combination with a banjo is a flat ring held in the top of its circular frame, the ring having a circular raised part on its upper surface; in combination with the ring, also, is a circular wire placed in a circular groove in the top of the ring, whereby the sounding or vibrating surface of the head of a large banjo is reduced, thus giving it a milder and sweeter tone.

A water cup for stove pipes has been patented by Mr. Samuel T. Atkin, of Georgetown, Tex. This invention relates to water holders on the outside of stove pipes, where the heat of the pipe is made to evaporate the water to impart moisture to the air, and consists in a receptacle made to partly encircle the pipe, and with hooks or ears on its sides, whereby it may be readily hung on the protruding ends of the damper spindle, or on studs or pin projections, etc.

A sanitary ice chest pail has been patented by Mr. William W. Woolsey, of Aiken, S. C. This invention consists in a pail provided at its top with a cup on the inner surface, so a trough is formed to receive water and form a seal for the cover, to protect the contents of the pail from contamination, the pail being so made as to take up but little space in the refrigerator, while permitting the cooling of the contents.

An ink grinder has been patented by Mr. William Y. Schmucker, of Reading, Pa. It has a saucer clamp and a chuck adapted to hold the solid ink cakes or sticks and to be revolved above the saucer, and has means to feed the ink cake downward as it wears away by friction on the saucer, the device being adapted to hold ink cakes of various shapes and sizes, and making a simple and inexpensive machine for "rubbing up" India ink to proper liquid consistency, for the use of engineers, architects, draughtsmen, etc.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter,** should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Minerals sent for examination should be distinctly marked or labeled.

(1) E. D. asks (1) what are the adulterations of linseed oil? A. The principal adulterants of linseed oil are cottonseed and fish oil. 2. Also how to detect them? A. The best means of detecting the presence of these substances is experience in handling them. There are no easy chemical tests that can be applied. Determinations of specific gravity and behavior with certain reagents afford clews, but they must be performed by those acquainted with the properties of their various adulterating oils. 3. How white lead is made by the old or slow process. A. The Dutch process is as follows: Conical glazed earthenware pots 8 inches wide are filled to one-fourth of their depth with malt vinegar. At one-third of the height of the pot from the bottom are three projecting points on which a cross piece of wood is laid, and on this are placed vertically a number of leaden plates rolled up into a spiral, and the whole covered with a leaden plate. The pots are then placed under a shed in rows upon horse dung or spent tannery bark covered with boards, another layer of dung or decomposing bark laid upon the boards, and on this another row of pots, many rows of pots being thus placed above one another, and the whole covered by the tan or dung. By the slow decomposition of the dung heat is evolved, which assists the evaporation of the vinegar and causes basic lead acetate to be formed, and this in contact with the carbon dioxide evolved from the putrefaction of the organic matter is converted into white lead. In the course of from 4 to 5 weeks the greater portion of the lead is converted into white lead, the change taking place from without inward. The white lead is then detached, ground into a fine paste while moist, washed well to free it from adhering acetate, and dried in small round pots.

(2) J. M. F.—If you mean to ask which will freeze first, water that has been recently boiled and cooled down to the same temperature as water that has not been boiled, and then both kinds exposed at the same time and under same conditions, the boiled water will freeze faster than the unboiled. The boiled water being deprived of its air seems to give up its heat faster than the aerated water. The evaporation we think has very little to with it, as a corked bottle of boiled water will freeze quicker than a bottle of unboiled water, both alike in condition.

(3) F. J. J.—Old coins cannot be given the same tone and brilliancy as new ones. Silver coins may be boiled in soda water and scoured with brush and whiting. Copper coins may be treated in the same way, and then brushed with plumbago, which gives the surface a bronze effect. This can be heightened by mixing a little rouge with the plumbago.

(4) C. J. R.—There are many receipts for waterproofing boots and shoes. The best is simply an extra dressing of oil or currier's stuffing.

(5) C. W. V. desires a good receipt for making soap powder, or washing powder. A. The soap powders, which for the most part are sold under fancy names, consist of partly effloresced sal soda mixed with its weight of soda ash. Some makers add a little yellow soap coarsely ground, to disguise the appearance of the stuff, and others a little ammonium carbonate or borax. The following liquid is also productive of good results: Pour two pails boiling water on one pound of unslaked lime and three pounds of sal soda. Bottle when clear.

(6) T. H. P. asks: 1. At what elevation must a tank of water be placed to give a pressure of 100 pounds on 1 inch pipe? A. 224 feet. 2. Does pressure vary with size of pipe? A. Pressure per square inch is the same without reference to size of pipe. 3. Is pressure greater if the pipe is more nearly perpendicular? A. Pressure is derived from the vertical height. Length of pipe may vary without affecting pressure. 4. Does size of tank make any difference? A. No. 5. Can you give rule for obtaining pressure given from different heights and sizes of pipe? A. Divide the height in feet by 2·239 for pressure in pounds per square inch.

(7) J. H. W.—Tarred paper for lining house walls has an objectionable odor, which we think would make it a nuisance. Asbestos building felt is not objectionable, but rather expensive. The heavy paper called building boards is much used for ceilings.

(8) E. G.—Leather is the best material to pack hydraulic pistons. Make the leather cupped if possible. The press plunger being 2 inches diameter would have an area of 3·14 inches, and 30 pounds pressure would make its lift equal to 93 pounds.

(9) R. L. G.—For motors, consult articles mentioned in catalogue of SCIENTIFIC AMERICAN SUPPLEMENTS, given in our issue of December 6, 1884. Artificial meerschaum may be made by immersing carbonate of magnesia in a warm solution of silicate of soda or potash for some time, or by precipitating from a solution of Epsom salts by means of the silicates.

(10) L. W. W.—Coal tar is a residue obtained from gas works, and used principally for the manufacture of its distillation products, which in their turn form the basis of the great color industries.

(11) S. W.—An inferior variety of bird lime can be made by boiling linseed oil for some hours until it becomes a viscid mass. The fly paper mixture is prepared as follows: In a tin vessel melt together one pound of resin and add two fluid drachms of linseed oil. While the mixture is warm dip a spatula into it, and spread what adheres to the blade on paper. Different samples of resin require varying proportions of oil to make it spread properly.

(12) J. C.—Strips of sheet steel and sheet brass will make a thermostatic bar. You will have to make an experiment as to the strength, it depending entirely upon the length, thickness, and breadth of the strips.—In desiccating eggs, the eggs are broken and the contents beaten together and slowly dried by suitable machinery, the construction of which is protected by patents.

(13) F. A. W. asks: 1. Will a mixture of hypophosphite of soda and gum arabic mucilage keep? (Say 1 ounce hypophosphite, 2 ounces gum, and 16 ounces water.) If not, what can I add to make it keep from spoiling, moulding, decomposing? A. We would recommend the addition of some antiseptic, such as salicylic acid, oil of cloves, or carbolic acid. 2. Will crystal bicarbonate of soda dissolve more freely in water than the ordinary commercial soda, that is, will more of the soda crystals remain in solution, my object being to make as strong a solution as possible? A. 16·69 parts of the crystallized salt are soluble in 100 parts of water at 70° C.

(14) R. S. writes: Can you give me a cure for baldness, and to make the hair grow? A. The "Treatment of Baldness" is described by Dr. G. H. Rohe in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161. In SCIENTIFIC AMERICAN SUPPLEMENT, No. 173, Dr. Shoemaker writes concerning the "Remedies for Baldness and Proper Treatment of the Hair." Pilocarpine for Baldness" is suggested in SCIENTIFIC AMERICAN SUPPLEMENT, No. 231. O. Lassar describes the "Cause of and Treatment for Premature Baldness" in SCIENTIFIC AMERICAN SUPPLEMENT, No. 416.

(15) D. C. writes: 1. Is there anything that will cover the cracks of patent leather? A. Use the following: Take ½ pound molasses or sugar, 1 ounce gum arabic, and 2 pounds ivory black; boil them well together, then let the vessel stand until quite cooled; after which bottle off. This is an excellent reviver, and may be used as a blacking in the ordinary way, no brushes for polishing being required. 2. Of what does French enamel leather consist? A. The term "enameled" is applied when the leathers are finished with a roughened or grained surface, while "patent" is used to designate the smooth finish. The process in each instance is similar. The greatest perfection in this branch of the leather industry has been achieved in France. 3. What is put on cuffs and collars to make them so smooth and shine so when first bought, and how made? A. See answer to query 77, in SCIENTIFIC AMERICAN for February 7, 1885.

(16) D. C. asks: 1. What is the explosive compound used in railroad torpedoes? The main constituent seems to be sulphur, with broken glass to make it explode, for without the glass no concussion will make it explode. A. The composition of the explosive mixture varies according to different makers. Gunpowder is used in some instances, while fulminating powder is employed in others. Sometimes percussion caps are used in connection with the foregoing. Other mixtures probably consist of phosphorus, sulphur, niter, and potassium chlorate in varying proportions. 2. What will I add to any of the ordinary inks to make them glossy? A. See answer to query 30, in SCIENTIFIC AMERICAN for December 20, 1884.

(17) C. E. F. writes: I make soap by the cold process, but cannot get it hard enough. Is there no way of using something to harden it? What do they use the soapstone for? A. Try the following: A mixture of either 60 pounds tallow, or 30 pounds each of tallow and palm oil, with 40 pounds of cocoanut oil, treated by the cold process with 125 pounds caustic soda lye of 27° Baume and 25 pounds salt water of 12° Baume, will turn out 244 pounds washing soap. A little powdered resin will assist the soap to harden. Soapstone or steatite is a mineral which when finely powdered is added as a "filling." By its use the quantity of water contained in the soap may be increased, but in most instances it is added simply as an adulterant or make-weight.

(18) C. R. P. asks how to make gold writing ink. A. Gold 24 leaves, bronze gold ¼ ounce, spirits of wine 30 drops, best honey 30 grains, gum arabic 4 drachms, rain water 4 ounces. Rub the gold with the honey and gum, and having mixed it with the water, add the spirit.

(19) C. W. W.—The method of robbing steam of its oxygen by passing it over red hot iron filings or turnings is old. It is true that the oxygen will unite with the iron, but the great obstacle which has so far stood in the way of the practical application of this idea, has arisen from the impossibility of building a strong and durable retort of a material that would remain unaffected by the passage, when red hot, of steam through it. Generally the retort is destroyed about as rapidly as the filings.

(20) J. R. B. desires information on bronzing for picture frame work; and the burnish bronzing. A. The bronzing of wood, which is what we presume you refer to, consists in first covering it with a uniform coating of glue or of drying oil, and when nearly dry the bronze powder, contained in a small bag, is dusted over it. The surface of the objects is afterward rubbed with a piece of moist rag. Or the bronze powder may be previously mixed with the drying oil, and applied with a brush. The bronzing of plaster is slightly different.

(21) E. C. A. asks how to obtain from wheat bran the gluten which is so highly recommended for dyspepsia. A. It can be obtained by kneading wheat flour or wheat bran in a sieve with water. The starch is washed through, leaving the gluten behind. It consists of various substances known as gluten fibrin, gluten casein, mucedin, and gliadin.

(22) E. B. D. asks how pickles made of cucumbers are put up for the market. A. Small cucumbers, but not too young, are put into a jar, and boiling vinegar with a handful of salt poured on them. Boil up the vinegar every three days, and pour it on them until they become green; then add ginger and pepper, and tie them up close for use, or cover them with salt and water (¼ pound salt to 1 quart water) in a stone jar; cover this and set them on the hearth before the fire for two or three days, till they turn yellow; then put away the water, and cover them with hot vinegar, set them near the fire, and keep them hot for eight or ten days, till they become green; then pour off the vinegar, cover them with hot spiced vinegar, and keep them close. Half a dozen peppers improve a jar of cucumbers, as the heat of the former is absorbed by the latter.

(23) W. P. B. writes: I have a customer who uses large numbers of books; they have to be frequently referred to year after year. Lately rats and mice have invaded his premises, and nothing seems to suit their tastes as his books, and consequently he is put to much annoyance and considerable loss. In the same room that the books are kept in are large numbers of paper boxes covered with green glazed paper, that the rats avoid, on account, I suppose, of the arsenic. Can you suggest any plan by which the books can be bound so as to protect them from rats and mice? Would arsenic mixed in the glue and paste, and having the waste leaves made of green glazed paper, protect the books from being cut to pieces? A. It is perfectly feasible to add arsenic to the paste or glue used in preparing the books, but the use of the adhesive under such circumstances might lead to the poisoning of those using it. The oil of rhodium is said to be very attractive to rats, and by baiting traps sprinkled with a few drops of this substance you would probably be successful in catching a large number of these obnoxious vermin.

(24) W. P. D.—The general process for making zinc plates consists in coating the plate with some substance, such as wax or bitumen, which is not attacked by acids, cutting out the design with a knife or etching instrument, and then treating with acids which eat into the zinc, leaving the part protected untouched. The wax is then removed and the plate electrotyped, and the electro used to print from. The process you will find quite satisfactorily explained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 344.

(25) J. T. writes: I have been troubled these last two years with fatty secretions in the skin of my face, which bear resembance to white worms. I extract them every day by pressing with my fingers, but they come as fast as I take them out. If you will be kind enough to give me a receipt, I will be very thankful? A. The white bodies to which you refer are simply accumulations of sebaceous matter in the hair follicles of the skin. They are often spoken of as "worms," but not correctly, for they have no organic constitution whatever, and they are of no importance except as they cause pain and annoyance. They are exceedingly common between the ages of 14 and 20 to 22, generally disappearing after that limit. No medicines or appliances are known which really produce any decided effect upon them, except that if the digestion is imperfect, remedies which will improve it will be of service. It is a curious fact that in the sebaceous glands which lie by the side of the hair follicles and open into them a very remarkable entozoon, which might be called in common language a *worm*, has actually its home, but it has nothing to do with the masses to which you refer, for it is microscopic in size, being only one one-hundred-and-twentieth to one sixtieth of an inch long, and about one-sixth part as thick. It apparently causes no trouble. It was first described by Dr. Simon, of Berlin, in Muller's *Archiv* in June, 1842, and in 1844 was described at large with many figures by Erasmus Wilson, in the Philosophical Transactions of the Royal Society of London.

(26) A. E. C. asks: 1. What is the composition of Fehling's solution, mentioned in a recent number of your paper as a test for glucose in cane sugar? A. Dissolve in water sufficient to make a liter 34·64 grammes well formed crystals of cupric sulphate, 173 grammes crystallized Rochelle salts, and lastly 52 grammes of sodium hydroxide. 2. How many volumes of gas can be obtained by electrolysis from one volume of water? A. The electrolysis of water yields two volumes of hydrogen and one of oxygen. Steam is said to be the condensation of these three volumes into two.

(27) C. F. B. asks: 1. Is there any method of using old rubber boots and shoes so as to make rubber cement from them? A. Rubber cements are made as described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 249, using old rubbers chopped fine instead of pure rubber. 2. What is the formula for the making of the celebrated washing compound that is being sold over the country? A. It may be the following: Pour two pails of boiling water on one pound of unslaked lime and three pounds of sal soda; bottle when clear. 3. Formula for making this great grease and stain extractor? A. The following is frequently used: soft soap and fuller's earth, of each half pound; beat well together in a mortar, and form into cakes. The spot first moistened with water is rubbed with a cake, and allowed to dry, when it is well rubbed with a little warm water, and rinsed or rubbed off clean. See also page 2511 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 158.

(28) J. C. P. asks: 1. For a receipt for waxing fish bait flies, gang hooks, splices, etc.? A. Use a mixture of beeswax and shoemaker's wax. In winter the quantity of the latter is in excess, while in summer more of the beeswax is used. These two ingredients are mixed together in a suitable vessel over a water bath. 2. Also one for transferring on glass to keep transfer from blistering? A. Triturate 1 drachm powdered gum tragacanth with 6 drachms glycerine; add by degrees, with constant trituration, 10 fluid ounces water. This will produce a mucilage without the objectionable air bubbles incidental to agitation. Add a little antiseptic (oil of cloves or creosote) to prevent decomposition.

(29) J. B. asks for a plan for calcining cork by the quantity? A. The process would be similar to that used in the preparation of charcoal for gun powder. This you will find described in various technical cyclopædias.

(30) J. W. C. writes: I want a very strong mucilage for binding books and papers. Is there anything I can put into gum arabic to make it stick better? A. Four parts by weight of glue are allowed to soften in fifteen parts cold water for some hours, and then moderately heated until the solution becomes quite clear; sixty-five parts boiling water are now added with stirring. In another vessel thirty parts starch paste are stirred up with twenty of cold water, so that a thin milky fluid is obtained without lumps. Into this the boiling glue solution is poured, with constant stirring, and the whole is kept at the boiling temperature. After cooling, ten drops carbolic acid are added to the paste to prevent souring.

(31) A. G. R.—The forward part of an engine is toward the crank. All stationary engines of the horizontal type (unless made for some special purpose) are made to move forward with a rising crank; by this motion the crosshead always bears down on the slides.

(32) P. W. A. asks: What is the microscopic test for bogus butter; also the test by qualitative analysis? A. When pure butter is examined under the microscope, the whole field is filled with extremely fine globules, which are entirely destitute of any approach to crystalline form. If the butter is artificial, or a mixture of both, the field presents numerous angular or acicular particles between the globules. For the chemical examination try the following: The butter to be examined (if in the form of butter) must be first melted and rendered pretty free from water and salt, by filtration if necessary; ten grains are then to be put into a test tube, and liquefied by placing the tube in hot water at about 150 degrees Fahrenheit; remove the tube when ready, and add 30 minims of carbolic acid (Calvert's No. 2 acid, in crystals, one pound; distilled water, two fluid ounces). Shake the mixture, and again place it in the water bath until it is transparent. Set the tube aside for a time. If the sample thus treated be pure butter, a perfect solution will be the result; if beef, mutton, or pork fat, the mixture will resolve itself into two solutions of different densities, with a clear line of demarkation; the denser of the two solutions, if beef fat, will occupy about 49·7, lard 49·6, mutton 44 per cent of the entire volume; when sufficiently cooled, more or less deposit will be observed in the uppermost solution. If olive oil be thus tested, the substratum will occupy about 50 per cent; with castor oil there is no separation. With some solid fats (not likely to be used fraudulently) no separation whatever takes place; the addition of a minute portion of alkanet root will render the reading of the scale extremely distinct by artificial light. The author states that the above method (although not intended to surpass other processes) is capable of wide application; the saving of a large amount of time and the reliability of its results will at once recommend it as a "first step" in butter analysis.

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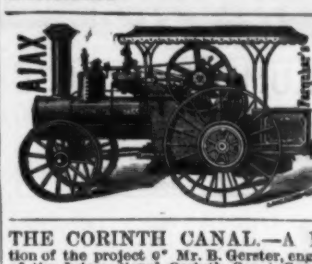

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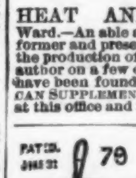

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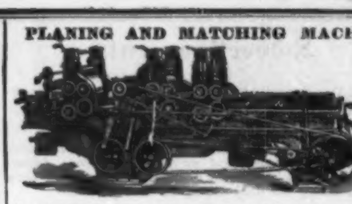

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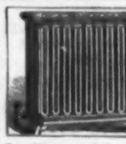

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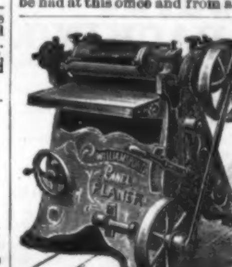

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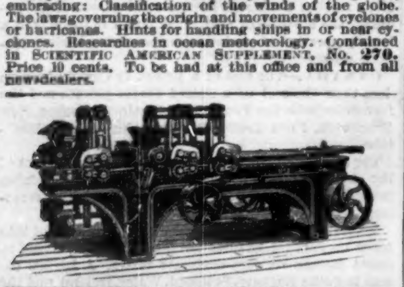

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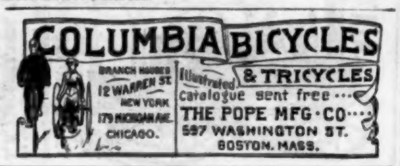

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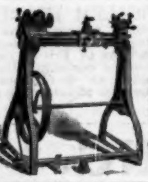

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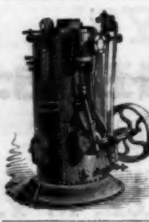

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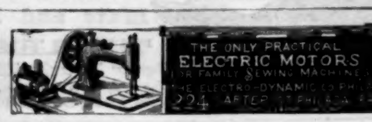

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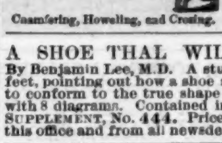

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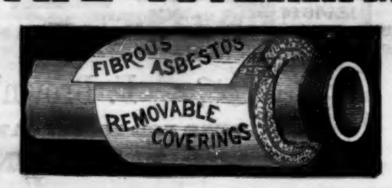

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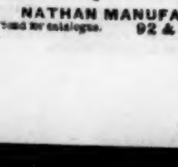

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